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**THE EPIDEMIOLOGY OF PHYSICAL TRAINING
INJURIES IN U.S. ARMY INFANTRY TRAINEES:
METHODOLOGY, POPULATION, AND RISK
FACTORS**

**U S ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts**

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<p>This is a longitudinal study of the epidemiology of training associated injuries conducted among 303 men in U.S. Army Infantry One Station Unit Training (OSUT) at Fort Benning, Georgia. The goals of this study include: a detailed anthropometric and historic evaluation of the population; a detailed description of the types of morbidity occurring during training; measures of the incidence of injuries; and identification and quantification of risk factors for injury.</p> <p>The subjects were assessed for potential risk factors for injuries via questionnaire and physical measures prior to the onset of training. All injuries occurring during 13 weeks of OSUT were identified.</p> <p>Of the 303 subjects entered into the study, 139 (45.9%) suffered at least one injury resulting in a sick-call visit. These injuries resulted in 969 days of lost or modified training. One hundred twelve (37%) experienced at least one musculoskeletal injury to the lower back or lower extremities. One hundred seventy two separate musculoskeletal injuries</p>					
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→ were experienced at 147 sites. Among the Army trainees, the sites and types of injury occurrence is generally similar in rank order to that reported in other studies, both civilian and military. This indicates that injuries being experienced among military trainees are of the same nature of those being experienced by other running populations.

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Human Research

Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

The views, opinions, and findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other official documentation.

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THE EPIDEMIOLOGY OF PHYSICAL TRAINING INJURIES IN U.S. ARMY
INFANTRY TRAINEES: METHODOLOGY, POPULATION, AND RISK FACTORS

by

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TABLE OF CONTENTS**Page**

Acknowledgements	i
Table of Contents	ii
List of Tables	iii
List of Appendices	v
Abstract	vi
Introduction	1
Methods and Materiels	5
Results	
Description of the Population	11
Company of Assignment	17
Injuries	17
Evaluation of Risk Factors	17
Discussion	22
Conclusions	30
References	32
Tables	T-1
Appendices	A-1

LIST OF TABLES

TABLE 1. Most Frequently Listed Pre-enlistment Occupations and Subjective Assessment of Activity Required by Pre-enlistment Occupation

TABLE 2. Self-assessed Level of Activity and Physical Fitness

TABLE 3. Most Frequently Mentioned Organized Sports and Fitness Activities

TABLE 4. Years of Smoking and Average Daily Consumption of Cigarettes

TABLE 5. Descriptive Statistics for Summary Measures from Minnesota Leisure Time Activity Scale

TABLE 6. Site and Type of Previous Injury

TABLE 7. Physical Measures and Flexibility

TABLE 8. Measures of Physical Fitness on Entry to Basic Training

Table 9. Variables and Coefficients Used for Imputing Diagnostic 2-Mile Run Time and 2-Minute Pushups

TABLE 10. Quartiles and Ranges of Diagnostic/Imputed 2-Mile Run and 2-Minute Pushups

TABLE 11. Sites and Types of Injuries Experienced During Basic Training

TABLE 12. Age, Ethnicity and Education as Risk Factors for Injury

TABLE 13. Measures of Activity and Fitness as Risk Factors for Injury

TABLE 14. Cigarette Smoking History as Risk Factor for Injury

TABLE 15. Previous Injury as Risk Factor for Injury

TABLE 16. Current Health Problems as Risk Factors for Injury

LIST OF TABLES (cont)

TABLE 17. Quintiles and Ranges of Anthropometric Measures as Risk Factors for Injury

TABLE 18. Percentiles and Ranges of Fitness Measures as Risk Factors for Injury

TABLE 19. Quintiles and Ranges of Total METs Expenditures as Risk Factors for Injury

TABLE 20. Multivariate Models for Risk of Injury

INTRODUCTION AND BACKGROUND

Injuries to the lower extremities are a major source of temporary disability for individuals who engage in strenuous weight bearing activities such as running or marching. Unfortunately, most research to date has been based on clinical reports and case series (1,2), so the epidemiology of these injuries has not been well documented. Studies to date have found high levels of self reported injuries in recreational runners (cumulative incidence over 30% in a year), but information concerning quantification of specific injuries, the types and nature of exposures, and other risk factors is scant.

These injuries deserve careful study because of the large numbers of people involved in physical fitness programs and activities that place them at risk. It has been estimated that 12 million to 30 million Americans engage in recreational or competitive running (3,4). The Armed Forces of the United States also have large numbers of adult men and women who undergo rigorous physical training, both on entry into the service and to maintain certain standards of physical condition. The U.S. Army alone sends about 200,000 trainees to basic training each year (5).

Estimates of the rates of overuse and traumatic injuries vary between studies. This may be a function of different operational definitions of injuries, different study designs, or populations with different characteristics being evaluated. There have been few well designed studies of injuries in specific

populations (1,2). A self-selected sample of 543 subjects returned questionnaires available at sporting goods stores, and 426 of these returned a follow-up questionnaire, including a check list of injuries, after six months. Fifty eight percent reported sustaining an injury within the past two years, and at follow-up 33 percent reported an injury in the past six months (6). A random selection of 355 males and 96 female entrants into another 10 km. road-race were questioned about running-related injuries incurred in the previous two years. Overall, 46.6 percent reported an injury severe enough to restrict their running (7). A one-year follow-up survey (by mail) of 2500 randomly selected 10 km. road-race entrants found an injury incidence of 37 percent among men and 38 percent among women, with injury loosely defined as any running associated injury causing a decrease in mileage, the taking of medicine, or consulting a health care professional (8).

Another report reviewed three studies (9) of different populations. In the first, runner members of an athletic club responded to a mailed questionnaire, and 24% of the respondents reported experiencing an injury in the previous one year. In the second, clients of a sports medicine clinic were interviewed, and subsets of runners and non-runners were identified. Subjects were followed over a four year period, and physician diagnosed orthopedic problems were assessed. At the end of the follow-up, the only difference between groups was for knee injuries, which was higher for runners (1.99% vs. 0.79%). In the final

study, entrants into a worksite health promotion program were evaluated. Those beginning a run/jog/walk program had a 3 month incidence of 9%, while those who were previously enrolled had an incidence of 6.6%.

Most studies of injuries in civilian populations may suffer from selection bias, in that subjects were self selected or were competitive runners, or both. Such studies may also suffer from information bias, in that injuries were generally self-reported and to some extent self-diagnosed.

Several studies of military populations have examined lower extremity injuries. Marine trainees were followed during their 11 week cycle (10), and experienced an overall incidence of injury (below the knee only) of 37 percent. Another study by the same researcher conducted among Army basic trainees found a cumulative incidence of 23% for sick call visits for lower extremity problems among men (11), during the eight week training cycle. A more recent study of Army trainees followed over eight weeks of basic training reported a lower extremity injury incidence of 25 percent in males and 46 percent in females (12).

In military populations, the impact of training injuries must be measured not just by their frequency but also in terms of direct medical costs for evaluation and treatment, and time lost from training and failure to complete basic training. One study (11) reported 580 days of limited duty among 310 male and female trainees due to all injuries (90 percent of total injuries were

lower extremity injuries). In comparison, there were only 42 days of limited duty due to illness during the same period. A 1978 study (8) conducted at Fort Jackson, S.C. reported an average of 13 days lost from training per lower extremity injury for women (data on males not reported), while another study at the same site in 1980 found females lost eight days per injury and males four days (11).

A number of factors have been postulated as increasing the risk of injury. These include intrinsic factors such as age, ethnicity, gender, levels of fitness, obesity, and anatomical malalignments; and extrinsic factors including footwear, running surface, intensity of training, and rate of increase of training. Few of these have been adequately evaluated in epidemiologic settings. The relative importance and magnitudes of these potential risk factors and others have not been clearly defined or quantified in epidemiological or clinical settings (1,2). For these reasons, this study was designed to examine specific intrinsic and extrinsic risk factors prospectively. The specific intrinsic risk factors under consideration include: demographical variables (age, ethnicity); anthropometric and anatomic variables (height, weight, body mass index [BMI], body fat percent [BF%], flexibility); current and past types and levels of activity; current physical fitness (strength and endurance); and previous injuries. The extrinsic variable under consideration is the training itself, which consists of various types of physical activity, with running and marching being the

principal components. This report addresses the methods used to assess these variables, describes the population and variables, and provides preliminary evaluation of these as risk factors for injury. As data analysis continues further reports will be published.

METHODS AND MATERIALS

This was a longitudinal study designed to quantify the types and incidence of injuries, and to evaluate risk factors for injury. Two separate companies (Company 1 and Company 2) of trainees entering U.S. Army infantry One Station Unit Training at Fort Benning, GA, in February 1987, were prescreened for risk factors by questionnaire and physical evaluation, and then followed for the duration of their training cycle of thirteen weeks. Subjects volunteered to participate after being informed of the nature of the study. The questionnaire was administered and physical measures obtained prior to the initiation of basic training.

Questionnaire

The questionnaire (see Appendix A, Questionnaire) was administered to all volunteers which collected basic demographic information, including age, self-reported ethnic group, and level of education. The trainees listed the title of the job they had just before entering the military, and estimated the level of physical activity required by this job.

Subjects were asked to assess their physical fitness relative to others their age; and questions were asked about previous levels of activity and participation in organized sports and fitness activities. A cigarette smoking history was obtained, and considered as a fitness factor.

The questionnaire included a section based on the Minnesota Leisure Time Activities (MLTA) scale (13), which collected detailed information about participation in 28 sports and fitness activities in the past year. The information included the number of months the individual engaged in the activity, the number of days per month, and hours per day. Also, the individual was asked to estimate the level of effort (LOE) he expended when engaging in the activity. This was based on a five point scale, ranging from very easy (breathing easy, about the same as a walk), to very hard (breathing labored, very difficult to keep going, effort similar to an all out run).

The level of energy required for each activity was converted to METs (14), which is based on the concept that the level of energy expended in an activity can be expressed relative to the level of energy required to sit quietly. This measure is not a function of the weight of the individual, as is the measure of caloric expenditure per minute (kCal/min). METs and kCal/min may be converted to one another if the weight of the individual is known.

The MET value for each activity was obtained from the literature (14,15). When a range of MET values was available for

an activity, the low estimate was assigned to the lowest LOE and the high estimate to the highest LOE, and the range divided equidistant over all LOE. If only a point estimate of METs was available, this was assigned to the midlevel LOE (moderate, breathing definitely increased but not uncomfortable), and increments of 25% of the point estimate were assigned to LOE above and below the midlevel.

Summaries of METs expended in the previous year were obtained, and grouped as Total METs, Total Upper Body (from those activities affecting the upper body, such as weight lifting and martial arts), and Total Lower Body (from those affecting the lower body, such as basketball, running, and hiking).

A history of injuries resulting in various levels of disruption of routine was collected, and subjects were asked about injuries to specific sites and specific musculoskeletal injuries to each of these sites. In the event that multiple previous injuries were noted, the most recent event was the one considered.

The trainees were queried about specific symptoms occurring in the past two weeks, including nausea, vomiting or diarrhea (excluding that associated with excessive alcohol consumption), fever, or a cold or flu. Subjects were asked about current back or foot problems that sometimes interfere with their daily activities, and to provide a self-assessment of their legs (bowed legs or knock kneed) and feet (high arches or flat feet).

Physical Measures

After administration of the questionnaire, anatomical and physical variables were measured. Height, weight, and neck and waist girth were obtained. Based on these measures, the Quetelet body mass index (BMI) using metric units ($\text{weight}/[\text{height}^2]$) (16), and body fat percent (BFP) were calculated. Fifteen second standing pulse rate was obtained at this time.

A general measure of back and hamstring flexibility was obtained using Wells' sit-and-reach flexibility test (17-20). Results are reported as inches from (negative numbers) or beyond (positive numbers) the toes which the subject could reach.

Anterior and lateral photographs were taken of the legs, with anatomical landmarks highlighted with markers. Four plane photographs (medial, plantar, anterior, and posterior) were taken of the feet, both weight bearing and non-weight bearing with anatomical landmarks highlighted. These photographs will be digitized, and aspects of leg and foot anatomy quantified for data analysis. The results from these analyses will be presented in a later paper.

Upper body strength was measured with an incremental dynamic lift machine, measuring the maximum weight the subject could lift from the floor to headheight (MAXLIFT) (21), and the MAXLIFT to body weight ratio (MLWRATIO) was calculated. Subjects were instructed in proper technique prior to lifting (22). Machine design restricted the maximum weight lifted to 90.7 kg

(200 lb). The level of physical fitness on entry was objectively assessed by the subjects performance on an initial "Diagnostic Physical Fitness Test" (DXPFT) which was administered to one company (n=135) during the first week of training. This test, which consists of the maximum number of sit-ups and push-ups completed in two minute blocks, and a timed two mile run, was administered and scored in accordance with current Army regulations (AR 350-15 The Army Physical Fitness Program 18 Feb 86).

Training follow-up

During the training cycle, the physical training included calisthenics, running, marching, and confidence course exercises. Most physical training was conducted at the company level, with the company commander responsible. Information on the types and duration of training, including distances run and marched, were recorded daily by the company commanders (see Appendix B, Daily Training Log). The training database requires extensive survival analysis, and therefore only limited results will be presented in this report.

Injuries were monitored by a biweekly 100% record review of each company's medical records, conducted by a physician (BHJ). All potential sources of medical care were identified, and all medical records were made available. The primary outcomes of interest were musculoskeletal injuries to the lower back, legs and feet. The operational definition of an injury was a

complaint of disability or pain severe enough to cause the subject to seek medical care on his own initiative, or debilitating enough to interfere with his training activity. Other injuries which were not musculoskeletal in nature, such as lacerations, contusions, blisters and ingrown toenails, were documented but not included in the analysis of training injuries. The information extracted from the medical record included: date of visit; site and side of injury; specific final diagnosis; referrals to other care providers (e.g. orthopedics); and nature and duration of restricted duty due to injuries. Logistical and administrative constraints dictated that the diagnoses used for analysis were those entered into the medical record by the health care provider during the clinic visit.

Data analysis

All data were entered into a microcomputer using a database management system. Data were double entered for error control. The information was then transferred to a mini-computer, where data analysis was conducted using statistical packages. Analyses included calculations of incidence and relative risk (RR). Confidence intervals for relative risks were calculated using the method described by Rothman (23). Continuous variables were categorized (generally quartiles and quintiles), and risks assessed by category. Multivariate analyses and calculation of adjusted odds ratios and confidence intervals were conducted using logistic regression, and were based on coefficients and

standard errors for each variable under consideration (24). It should be noted that a high incidence ($>.10$) of injuries violates the rare-disease assumption required for an odds ratio to closely approximate the relative risk (25). Thus, while odds ratios may be compared to one another, and a high odds ratio corresponds to a high relative risk, odds ratios and relative risks should not be directly compared to each other.

RESULTS

Description of Population

Subjects

Three hundred thirty five trainees consented and completed questionnaires and had physical measures made. Two declined to participate, and no information was collected on them.

Between the administration of questionnaires and the beginning of the training cycle, thirty two trainees were lost to follow-up. These soldiers were either transferred to other companies prior to onset of training for administrative reasons ($n=24$), or were discharged from the Army for pre-existing medical problems or other reasons ($n=5$). Three subjects were lost to follow-up for unknown reasons. Thus, a total of 303 subjects (90.4% of those identified for participation) started basic training and were included in this study.

Demographic factors

Ages ranged from 17 to 35 years, and the overall mean age

was 20.3 years. The distribution was skewed to the right, with 75% 21 years or younger, only 9.6% older than 24, and 2.0% older than 29. The relationship between age and other variables is presented in Appendix C, Correlation Matrix. Eighty three percent had at least a high school diploma, and 29.0% had completed some college.

Most (81.1%) of the study subjects described themselves as white, while 9.8% called themselves black, and 5.7% Hispanic. American Indian, Asian, and unknown together totalled another 5.4%.

Occupational factors

There were 38 different areas of prior civilian occupation identified which could be placed into Department of Labor (DOL) categories, based on the DOL Dictionary of Occupational Titles (26). Table 1 presents the number and percentage of subjects for the five most frequently identified occupational categories. An additional 17 (5.6% of total) did not list any occupation, and may have been unemployed. Table 1 also presents the frequency and percent for the subject-assessed level of activity required by the job.

Activity, fitness, and smoking factors

Table 2 presents subjective self-assessments of the overall level of physical activity before coming into the Army, and self-assessments of current physical fitness, physical condition,

amounts of exercise in the last month, and weekly episodes of running or jogging. In addition, the total amount of time spent running or jogging is presented, categorized as none, some but less than 60 minutes per week, and 60 or more minutes per week.

Most of the subjects reported participating in some sort of fitness or sports activity. Two hundred fifty seven (84.8%) reported participation in 25 organized sports activities, ranging from church or intramural teams to varsity level participation. Two hundred ten subjects reported participation in 23 individual fitness activities just to stay in physical condition. The ten most frequently mentioned organized sports and fitness activities reported by the subjects are given in Table 3. Forty six individuals (15.2%) reported no history of sports or fitness activities, 25 (8.3%) reported one year of activity with no varsity letters, 159 (52.5%) reported two or more years without earning any varsity letters, and 73 (24.1%) earned one or more letters.

A history of cigarette smoking was obtained, and considered a fitness factor. Over half (52.5%) of the subjects reported smoking one or more cigarettes in the past year. The years of smoking and daily consumption are presented in Table 4.

MLTA data

The level of METs expended in the previous year varied widely between individuals, as shown in Table 5. Generally, more energy was expended on lower body activities than on upper body

activities. A correlation matrix of the summary measures of METs expended and other variables is presented in Appendix C.

Past injuries

Twenty six percent of the subjects reported having incurred an injury severe enough to cause them to miss work or school for at least one week. Nineteen (6.3%) reported a fracture, eight (2.6%) a knee injury, seven (2.3%) a car or motorcycle accident, 6 (2.0%) a back injury, and 5 (1.7%) cuts or lacerations. Most (80.1%) of these injuries had occurred in the previous five years. Thirty five percent had suffered an exercise related injury causing them to decrease or quit practicing for at least one week. Twenty five (8.3%) reported a fracture, 15 (5.0%) had a pulled muscle, ligament, or tendon, 14 (4.6%) had a sprained ankle, and 10 (3.3%) had a knee injury. Seventy nine (76.7%) of these exercise injuries occurred within the previous five years.

The body parts or areas injured are shown in Table 6, along with the days required to recover from the injury, and the proportion seeking medical attention for these injuries. The type or nature of injuries to the lower back or legs are presented in the same table, with the self-assessed level of severity for each injury.

The frequency and percents of subjects with other, current health problems or conditions include: cold or flu in last two weeks, 98 (32.3%); fever in last two weeks, 29 (9.6%); nausea, vomiting, or diarrhea in last two weeks, 31 (10.2%); problems

with feet limiting daily activity, 21 (6.9%); back pain limiting daily activities, 36 (11.9%); self-assessed bowleggedness, 27 (8.9%); self-assessed knock-knees, 14 (4.6%); self-assessed flat feet, 44 (14.5%); and self-assessed high arches, 21 (6.9%).

Physical examination and flexibility

The average height of the trainees was 178.3 cm (5 ft 10.2 in), while the average weight was 75.5 kg (166 lb 2 oz). The average Quetelet body mass index, based on metric units of height and weight, was 23.79, and the average bodyfat percent was 19.95. The average 15 second standing heart rate was 20.4. The mean for back and hamstring flexibility was 1.9 inches. More detailed descriptive statistics on the physical examination variables are presented in Table 7. The relationships between these variables are shown, with the MLTA data, in Appendix C, Correlation Matrix.

Physical fitness on entry

The mean maximum weight the subjects could lift was 71.5 kg (157.3 lb), and the mean maximum lift to body weight ratio was 0.954. Descriptive statistics on the number of repetitions for pushups and situps and the times for two mile runs, and the overall scores of these subjects is given in Table 8.

Because the DXPFT information was available on less than half the subjects, the use of these data in analysis was restricted. Therefore, forward stepping multiple regression was used to predict scores based on available information, and scores were imputed for those individuals missing the DXPFT data. Based

on the square of the maximum lift-to-weight ratio, the BMI, the total time spent running per week in the past month, the total METs expended in the past year, the time for the final 2-mile run, and the square of the time from the final two mile run, the DXPFT run time was predicted with a coefficient of correlation of 0.745 ($p < .0001$). Similarly, based on the square of the maximum lift-to-weight ratio, the final 2-mile run time, and the number of pushups completed at the final test, the DXPFT push ups were predicted with a coefficient of correlation of 0.703 ($p < .0001$). The models, variables and coefficients from the regression models are shown in Table 9. The relationships between the Diagnostic and Imputed scores and the MLTA data and physical examination are presented in Appendix C.

For analysis, the actual DXPFT time or count was used if available, and if not, the imputed value was substituted. The results were then grouped into quartiles, as shown in Table 10. For multivariate analysis, the reference group was defined as the 25% with the best performance, and was compared to the mid 50% and to the 25% with the worst performance.

Company of assignment

The two companies had different weight bearing training regimens. Company 1 marched (road marching and marching to and from training) a total of 117 miles, and ran 60 miles, covering a total of 177 miles. Company 2 marched 68 miles, and ran 130 miles, for a total of 198 miles. Other aspects of the training

schedules (e.g. calisthenics, obstacle and confidence courses, etc) were very similar.

Injuries

Of the 303 subjects entered into the study, 139 (45.9%) suffered at least one injury resulting in a sick-call visit. These injuries resulted in 969 days of lost or modified training. One hundred twelve (37%) experienced at least one musculoskeletal injury to the lower back or lower extremities. One hundred seventy two separate musculoskeletal injuries were experienced at 147 sites. The total number of lower extremity musculoskeletal injuries by type and site of the injuries is given in Table 11.

Evaluation of Risk Factors

For the determination of incidence and relative risk of injuries, the occurrence of the first lower back or lower extremity musculoskeletal injury is considered the endpoint. Later analyses will consider the association between risk factors and specific types of injury.

Risk factors for injury

The risk for injuries associated with demographic factors is shown in Table 12. Risk for injury did not increase linearly with age. However, those aged 24 and more had a significant 75 to 80% increase in risk of injury. Compared to whites, all ethnic groups had a lower risk of injury, although the decrease was not statistically significant. There was no significant

association between level of formal education and risk of injury.

When self-reported and subjective assessments of job related activity, general level of activity, fitness, condition, exercise, running, and sports participation were examined, there was a general trend towards increased risk of injury with decreasing level of each factor, as shown in Table 13. This finding was consistent for self-assessments of levels of activity, physical fitness, physical condition, frequency and duration of jogging or running.

Those who reported smoking in the past year had a significant 66% increase in risk of injury, as shown in Table 14. When levels of smoking were categorized by cigarettes smoked per day in the last month, those smoking zero to nine per day had a similar level of risk. Those who smoked 10 or more cigarettes per day had a non-significant increase compared to smokers who consume fewer cigarettes.

There was no apparent association between a history of an injury causing time lost from work or school, or exercise related injury, and subsequent training injury, as shown in Table 15. Nor were there any significant associations between site of previous injury and subsequent injury. When type of previous injury was considered, only ankle sprain was a significant risk factor, with a relative risk of 1.37. The associations between site, severity, and nature of previous injury and specific training injuries will be explored in a future paper.

When current health problems were considered, as shown in Table 16, there was generally a slight but not significant increase associated. Recent illness (cold or flu, fever, GI distress) were combined to consider the occurrence of any of these symptoms, and the 29% increase in risk associated with this was marginally significant, with $p < .10$. Those reporting foot problems which affect their daily activities had a statistically significant 61% increase in risk of injury.

There appeared to be a increase in risk with increasing arch height. Those with self assessed flat feet had a RR of 1.00, those with normal arches had RR of 1.33, while those reporting high arches had RR of 1.79. The RR for those with high arches was significantly greater than for those with low arches.

The physical measures were categorized into quintiles, except for the 15 second pulse, and associated risks are presented in Table 17. Due to the lack of spread for the 15 second pulse, this variable was placed into quartiles. Generally, there was no association between height, body mass index, body fat percent, and pulse, and training injury. For body weight, only the second quintile group (next to lightest) had a significant increase in risk of injury. For the flexibility measure, there was a definite U-shaped curve in risk, so that those who were most inflexible and most flexible were at significantly increased risk, compared to those in the third quintile. For multivariate analysis, this middle quintile was used as the reference group.

The measures of physical condition were also placed into quintiles, (except for MAXLIFT) and the associated risks are presented in Table 18. MAXLIFT was not associated with risk of injury. There was a J-shaped curve associated with MLWRATIO, but none of the quintiles were at significantly reduced risk.

When the Diagnostic/Imputed 2-Mile Run times and Pushups were considered, there was an increase in risk with decreasing performance. In these analyses, the best performing quintile was compared to the mid 50% and the worst performing 25%.

The results from the MLTA are given in Table 19. On univariate analysis, none of the levels of the variables was significantly associated with risk of injury.

Company 1 had an incidence of 32.5%, compared to 41.8% for Company 2. This results in a relative risk of 1.29 for Company 2, with a 95% confidence interval estimate of 0.96 to 1.73.

For multivariate analyses, the variables which demonstrated some trend toward changes in risk were re-categorized to provide larger cells with similar risks. Job activity was recoded as moderate or heavy vs. very light or light activity; past general activity as active and very active vs. inactive to average; self assessed fitness as poor to average vs. above average to excellent; physical condition as much worse to about the same vs. better or much better; frequency of exercise and frequency of jogging or running both regrouped as four or more times per week vs. less. Since the risk of injury by age was relatively

constant until age 24, ages were regrouped as 23 or less, and 24 or more. Ethnicity was coded as white vs. all other. Whenever possible, the group with the lowest risk was coded as the referent group.

The multivariate analysis was accomplished in two stages. First, a general main-effects model was constructed using all variables which were associated with an increase in risk, regardless of statistical significance. Complete information was available on 280 trainees at this stage. This model, reporting the adjusted odds ratios and 95% confidence interval estimates, is given in Table 20.

In the next step, variables were allowed to enter in a forward stepping manner, with controls to enter and exit the model set at default. The number of subjects with complete information at this stage was 293. The following factors were associated with a significant increase in risk: age 24 years or older; jogging or running less than four times per week; having a job requiring less than moderate or heavy levels of activity; smoking 10 or more cigarettes per day; and being in the least flexible or most flexible quintiles in the measure of back and hamstring flexibility. The adjusted odds ratios and confidence intervals are presented in Table 20.

Several other factors were associated with an increase in risk, although the 95% confidence bounds included 1.0. These factors, which are also presented in Table 20 include: history of low levels of activity; history of a previously sprained

ankle; performing in the worst 25% on the Diagnostic/Imputed Pushups test; and being a member of Company 2.

All variables which were included in the main effects model were then examined for interaction with each other. There were no significant interactions present.

DISCUSSION

Military populations of basic trainees offer opportunities for epidemiologic research which can not be duplicated in civilian populations. In Army basic training, large groups of individuals are routinely exposed to relatively high levels of physical stress. This study evaluates both historical self-assessed factors, such as previous injuries and levels of activity, and objective measures of fitness at initiation of the training program, as well as capturing 100% of adverse outcomes. This permits the description of the population, measures of incidence, and identification and evaluation of risk factors at a level of detail and accuracy not otherwise possible.

This population is composed of young males who self-selected for military service, were in generally good health, and with varying demographic backgrounds and experiences. The detailed description will permit accurate comparison with future research populations.

Given the numerous differences in study design between this and studies conducted among civilian populations, it is difficult to make valid comparisons of injury incidence. The calculated

average weekly incidence of 3.8% found here is similar to that reported from other studies in military populations, including Kowal (27), 3.7%, Bensei (10) 3.4%, Bensei (11) 2.9%, and Dziadosz (12) 3.1%. While the level of physical exercise exposure may differ quantitatively between various military training programs, the nature and type of exposure is similar. The populations are similar in age and most other demographic measures, but may differ in ethnic composition. It is felt that the percentage of black and Hispanic subjects in this study was unusually low.

Among the Army trainees, the sites and types of injury occurrence is generally similar in rank order to that reported in other studies, both civilian and military. This indicates that injuries being experienced among military trainees are of the same nature of those being experienced by other running populations.

On univariate analysis, several risk factors significantly associated with injury were identified, as shown in Tables 12 to 19. Multivariate analyses is useful in clarifying associations between risk factors and injury. In this analysis several of the variables identified on univariate analysis remained as significant risk factors when examined with logistic regression, although the odds ratios associated may have changed.

Age has not been a consistent risk factor in other reports, but most studies among civilians have involved men in their thirties and forties. Koplan et al (8) found no association

between age and injuries. Samet et al (6) found an inverse relationship with age, in that younger runners were more likely to have suffered an injury. This relationship was also found at the 1984 Boston Marathon, in that the risk of injury was 3.4 percent for men under 30 and 1.5 percent for men over 40 (BHJ, unpublished data). The subjects in these studies were self-selected elite runners, generally setting their own levels of frequency, duration, and speed of running. The comparability between these runners and recruits is questionable.

Bensel (11) found no difference in age for either men or women between those injured and those not injured, while Brudvig, et al, (28) reported a consistent increase in risk of stress fracture among Army trainees from ages 17-22 through 29-34. Other studies of military populations have not evaluated age as a risk factor. In the current study, the strength of the association ($OR=3.74$) and the lack of significant interactions with the other variables is evidence that age itself is an independent risk factor.

The level of physical fitness has been listed as a risk factor, but the direction of risk is not clearly defined. Samet et al (6) report that the risk of injury increased with years of running, independently of weekly mileage and age, while Jacobs et al (7) and Koplan et al (8) found that years of running were not associated with risk of injury. It is assumed that those with a longer running history are more physically fit than those with a shorter history. Presumably, those with a longer history of

running would be different than those with a shorter history, in that this population would have had those with predisposition to injury already removed, and that they would be in better physical condition. It is possible that this measure is confounded by factors such as age, history of injuries, and motivation.

Rapid substantial increases in training intensity, frequency, or duration is frequently noted as a cause of injury (19,29-33). This is consistent with the concept that small gradual changes in stress are followed by physiological adaptation, while large abrupt changes may overwhelm adaptative capabilities. Little quantification of the relative amount of increase needed to cause injury been accomplished. Powell, et al, (1) anticipate that the increase in risk of injury will be found to be proportional to the magnitude of increase in training, and state that this appears to be an important area for future research. This factor well may be related to, and confounded by, both levels of fitness and the absolute level of exercise.

Both of these hypotheses concerning physical fitness and relative changes in exercise are supported by the data showing that those reporting higher levels of activity at work and in the past, those who run or jog four or more days per week, and those scoring higher on the diagnostic/imputed 2-minute pushups, to be at lower risk of training injury.

A history of smoking, as defined by smoking one or more

cigarettes in the past year and by numbers of cigarettes smoked per day was also identified as a risk factor. It would appear that smoking is either a surrogate measure of a true risk factor, or that it is severely confounded by some other factor.

Others have found that smoking males are more likely to be risk takers (34), or to have higher "defiant, impulsive, and danger-seeking" traits (35). A study of airmen trainees found that smokers had more automobile accidents (36), and another study of workers found that smokers generally had more industrial accidents than did non-smokers (37). It is possible that smoking males behave in some unidentified manner which puts them at increased risk of training injury.

Among military populations, smokers have been found to perform more poorly on the APFT than non-smokers (38). A study of Swiss army conscripts found that those who smoked even lightly ran more slowly than those who did not smoke at all (39). It is conceivable that there is some underlying physiological factor which differentiates smokers from non-smokers, and which is also a risk factor for training injury, but it has not been identified. Among this population, there were no interactions among smoking status and other risk factors for injury.

In this study, there were no interactions found among the level of smoking and the other risk factors identified. While the actual etiological factor inherent to or associated with smoking is unknown, a history of smoking is a strong and significant risk factor for injury in this population, with an

OR=3.21.

Increased flexibility and range of motion have been considered protective factors in the literature (19,40,41). Indeed, recommendations have been made that runners and other athletes strive specifically to stretch connective tissues (30,42,43). The suggestions for improving flexibility generally are not quantified, are based on clinical impressions, and do not address excessive flexibility.

The results from this study indicate that both extremes of flexibility are at increased risk of training injury, with a very dramatic U-shaped curve of risks. The middle three quintiles include a fairly narrow range of values, encompassing 6.1 inches. The least flexible quintile, however, covers 8.2 inches, all reflecting an inability to reach to the toes. The most flexible covers 5.7 inches, with a maximum reach 11.2 inches beyond the toes. The underlying biological reasons for the increases in risk at the extremes is not known. The most flexible quintile had more ankle injuries and fewer calf injuries than the least flexible quintile, and more ankle sprains. These differences were not statistically significant, however. Controlling for age and unit, there were no differences in time to injury. While the least flexible may be different than the most flexible in some aspects, these differences were not evident in the outcomes studied.

A previous injury may act as a risk factor because the

original cause may remain, the injured tissue may not function properly, or the injury may not have yet healed completely (1). A history of previous injury has been associated with an increased risk of subsequent injury (44). This risk factor was identified on further analysis of the data collected from entrants in a 10 km road-race (8). A prospective four year study of physical education students reported that subjects with a previous injury were at increased risk of re-injury at the same site (45).

Among these Army infantry trainees, a general history of a previous injury was not found to be associated with an increase in risk, except for a sprained ankle. When evaluated in the multivariate model, an interesting pattern emerged. Those who had no history of previous injury had an odds ratio, by definition, of 1.00. Those who had any previous injury, exclusive of sprained ankle, had an adjusted odds ratio of 0.54, which was not significantly less than 1.00, while those who had a sprained ankle, regardless of any other injury, had an odds ratio of 1.75, which approached significance. On univariate analysis, there was a non-significant association between previous and subsequent sprained ankle, with a relative risk of 1.7.

The direction of the association between previous non-sprained ankle injury and training associated injury, and the opposite association when sprained ankle was considered, were both unexpected. These associations remained even when the other risk factors were controlled for in the multivariate model. The

lack of significant associations between historical and training associated injuries may reflect imprecision in the data collection instrument, or they may reflect inadequate sample size. This aspect must be investigated with more refined instruments in a larger population. In addition, a larger population will permit more refined analyses.

The differences in injury incidence between companies, with an adjusted odds ratio of 1.62, approached statistical significance on both univariate and multivariate analysis, and would likely have been significant had the study population been larger. There were no significant differences in trainees between the companies, but there were large differences in the type and amount of weight bearing training. It is likely that the number of miles run is the important difference between companies, leading to the increase in injuries in Company 2. Survival analysis is the most appropriate analytical method for evaluating this association, and will be presented in a future report.

CONCLUSIONS

This study has identified and quantified both the types and incidence of overuse musculoskeletal injuries, as well as risk factors for these injuries, among young males exposed to 13 weeks of strenuous physical activity encountered during Army Infantry training. The types and sites of injuries experienced are generally similar to those reported in other studies of runners

and military trainees.

The factors with significant risk of injury associated include age, levels of physical activity and possibly physical fitness, smoking history, and back and hamstring flexibility.

Several other factors were identified which were strongly suggestive but lacked statistical significance. A self-assessed history of low overall physical activity, and performing in the lowest quartile on the Diagnostic/Imputed pushups test were both associated with increases in risk which approached statistical significance. A history of a previous ankle sprain was associated with an increase in risk, while a previous lower extremity injury exclusive of an ankle sprain was associated with a decrease in risk, both of which approached significance. The company of assignment was a predictor of injury, with the company running the most and marching the least having a higher incidence of injury.

It is noteworthy that four of the factors significantly or suggestively associated with risk of injury reflect, in some manner, physical activity or fitness. It appears that those men who maintain some relatively high level of activity and fitness, either in recreational activities or due to occupational factors, are more capable of coping with the intense strenuous challenges presented during infantry training.

The U-shape curve of risks for back and hamstring flexibility indicates that not only is there not a monotonic

association between increasing flexibility and decreasing risk, but that those who are most flexible have a risk as great as those who are least flexible.

The different injury experience of the two companies provides evidence that the number of miles run are an independent risk factor. However, this hypothesis needs to be evaluated with survival analysis.

The results of this study have implications both for military training situations as well as any circumstance where young men will be entering a program of increased physical activity. The hypotheses generated with this study need to be refined and tested in larger populations for confirmation.

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TABLE 1. Most Frequently Listed Pre-enlistment Occupations and Subjective Assessment of Activity Required by Pre-enlistment Occupation

<u>Occupation</u>	<u>Frequency</u>	<u>% of Total</u>
Construction Occupations	37	12.2
Food Service	36	11.9
Sales Clerks	34	11.2
Employed, Not Codeable	23	7.6
Motor Freight Occupations	18	5.9

<u>Required Activity</u>	<u>Frequency</u>	<u>% of Total</u>
None to Light	90	29.9
Moderate	152	50.5
Heavy	59	19.6

TABLE 2. Self-assessed Level of Activity and Physical Fitness

<u>Previous Level of Activity</u>	<u>Frequency</u>	<u>Percent of Total</u>
Inactive	2	0.7
Not very active	28	9.3
Average	89	29.5
Active	103	34.1
Very active	80	26.5

<u>Self-assessed Physical Fitness</u>	<u>Frequency</u>	<u>Percent of Total</u>
Poor	4	1.3
Below average	27	8.9
Average	152	50.2
Above average	97	32.0
Excellent	23	7.6

<u>Self-assessed Physical Condition</u>	<u>Frequency</u>	<u>Percent of Total</u>
Poor or Below average	27	8.9
Average	162	53.6
Above average	100	33.1
Excellent	13	4.3

<u>Frequency of Exercise In Last Month</u>	<u>Frequency</u>	<u>Percent of Total</u>
None	29	9.6
Less Than Once/Week	39	12.9
About Once/Week	17	5.6
Two or Three/Week	133	43.9
Four or More/Week	85	28.1

TABLE 2 (cont)

Frequency of Jogging or Running In Last Month		
	<u>Frequency</u>	<u>Percent of Total</u>
None	74	24.5
Less Than Once/Week	34	11.3
About Once/Week	55	18.2
Two or Three/Week	94	31.1
Four or More/Week	45	14.9
Weekly Duration of Jogging or Running In Last Month		
	<u>Frequency</u>	<u>Percent of Total</u>
No Running or Jogging	79	26.3
Less Than 60 Minutes	136	45.3
60 Minutes or More	85	28.3

TABLE 3. Most Frequently Mentioned Organized Sports and Fitness Activities.

<u>Organized Sport</u>	<u>Frequency</u>	<u>% Subjects Participating</u>
Football	123	40.6
Track	73	24.1
Baseball	70	23.1
Basketball	59	19.1
Wrestling	38	12.5
Soccer	18	5.6
Swimming	7	2.3
Tennis	7	2.3
Volleyball	7	2.3
Golf	6	2.0

<u>Fitness Activity</u>	<u>Frequency</u>	<u>% Subjects Participating</u>
Running/Jogging	103	34.0
Weight Lifting	102	33.7
Calisthenics	38	12.5
Swimming	25	8.3
Racquetball	13	4.3
Basketball	12	4.0
Martial Arts	10	3.3
Football	6	2.0
Biking	5	1.7
Baseball	4	1.3

TABLE 4. Years of Smoking and Average Daily Consumption of Cigarettes

<u>Years of Smoking</u>	<u>Frequency</u>	<u>Percent reporting</u>
None	143	47.2
One or less	21	6.9
2	32	10.6
3	15	5.0
4	17	5.6
5	17	5.6
Six or more	45	14.9

<u>Average Daily Consumption*</u>	<u>Frequency</u>	<u>Percent of total*</u>
None	34	21.8
1-9	29	18.6
10-19	34	21.8
20 or more	59	37.8

* Among those with a history of smoking cigarettes.

TABLE 5. Descriptive Statistics for Summary Measures from Minnesota Leisure Time Activity Scale.

Activity Category	Mean	Median	SD*	Minimum	Maximum
Total MET	7036.7	4519.1	8266.2	0.0	66238.7
Total Lower- Body** MET	3627.4	2339.9	4130.8	0.0	25261.5
Total Upper- Body# MET	1779.1	552.0	4376.4	0.0	52737.2

TABLE 6. Site and Type of Previous Injury

<u>Site of Past Injury</u>	<u>Injury Frequency (%)</u>	<u>Days to Recover Median</u>	<u>Range</u>	<u>Sought Help* Frequency (%)</u>
Back	34 (11.2)	9	0-60	23 (67.6)
Hip	4 (1.3)	4	3-12	2 (50.0)
Thigh	14 (4.6)	3.5	2-100	4 (28.6)
Knee	46 (15.2)	11	0-90	30 (65.2)
Calf	7 (2.3)	6	3-30	4 (57.1)
Foot	25 (8.6)	1.5	0-9	21 (84.0)

<u>Type of Injury</u>	<u>Frequency (%)</u>	<u>Freq. by Severity@</u>		
		<u>1</u>	<u>2</u>	<u>3</u>
Fracture	22 (7.3)	0	2	16
Stress Fracture	7 (2.3)	0	2	4
Torn Cartilage	13 (4.3)	1	5	7
Torn Ligament	17 (5.6)	1	3	13
Sprained Ankle	102 (33.7)	31	46	14
Other Sprains	10 (2.3)	1	5	1
Tendinitis	2 (0.7)	0	1	1
Ruptured Tendon	4 (1.3)	0	1	2
Pulled Muscle	84 (27.7)	25	38	13

* Frequency and percent seeking medical attention for this injury.

@ Severity codes: 1=Injury did not affect daily activities; 2=Injury affected activities for 1-7 days; 3=Injury affected activities for more than 7 days.

Note: discrepancies between Frequency and Frequency by Severity reflect missing data.

TABLE 7. Physical Measures and Flexibility

<u>Variable</u>	<u>Mean</u>	<u>Median</u>	<u>SD*</u>	<u>Range</u>
Height (cm)	178.3	178.5	6.26	161.8 to 196.3
Weight (kg)	75.5	73.6	11.94	51.7 to 120.7
BMI**	23.8	23.3	3.21	17.8 to 32.5
BFP@	20.0	19.1	5.34	7.5 to 33.9
Pulse (15 sec)	20.4	20.0	2.69	14 to 29
Flexibility@@	1.9	1.7	3.88	-9.4 to 11.2

* SD: Standard Deviation.

** BMI: Quetelet Body Mass Index.

@ BFP: Body Fat Percent.

@@ Flexibility: Maximum reach before (negative numbers) or beyond toes (positive numbers).

TABLE 8. Measures of Physical Fitness on Entry to Basic Training

<u>Measure</u>	<u>Mean</u>	<u>Median</u>	<u>SD*</u>	<u>Range</u>
Maximum Lift**	71.6	72.6	12.14	36.3 to 90.7
MLWRATIO@	0.954	0.958	0.145	0.415 to 1.336
DXPFT@@ Situps	37.6	37.5	10.64	10 to 77
DXPFT Pushups	27.0	27.0	11.29	1 to 57
DXPFT 2 Mile Run	15.31	15.28	1.98	11.92 to 18.75
DXPFT Total Score	154.6	158	31.18	64 to 240

* SD: Standard Deviation.

** Maximum Lift: Maximum amount (kg) lifted overhead.

@ MLWRATIO: Maximum lift/body weight.

@@ DXPFT: Diagnostic Physical Fitness Test.

Table 9. Variables and Coefficients Used for Imputing Diagnostic 2-Mile Run Time and 2-Minute Pushups.

Imputed 2-Mile Run Time = $-31.16770541 + (-0.861 \cdot \text{SQPOWER}) +$
 $(0.148 \cdot \text{BODYMASS}) + (-0.006 \cdot \text{SUMRUN}) + (-0.00003 \cdot \text{TOTMETS}) +$
 $(5.632 \cdot \text{FINALRUN}) + (-0.174 \cdot \text{SQRUN})$

Model coefficient of correlation (R) = 0.745. R square = 0.555

Imputed 2-Minute Pushups = $7.303 + (12.721 \cdot \text{SQPOWER}) +$
 $(-1.552 \cdot \text{FINALRUN}) + (0.504 \cdot \text{FINALPUSH})$

Model coefficient of correlation (R) = 0.703. R square = 0.494

Variable explanations:

SQPOWER = Maximum lift-to-body weight ratio, squared.

BODYMASS = Quetelet body mass index (weight/(height*height)).

SUMRUN = Estimated time spent running or jogging each week in past month (calculated from number of episodes per week times average time spent running each episode).

TOTMETS = Total METs expended in past year. From Minnesota Leisure Time Activities Scale.

FINALRUN = 2-Mile run time during final Army Physical Fitness Test.

SQRUN = Square of FINALRUN.

FINALPUSH = Number of pushups completed during final Army Physical Fitness Test.

TABLE 10. Quartiles and Ranges of Diagnostic/Imputed 2-Mile Run and 2-Minute Pushups.

2-Mile Run Time

Q1 Fastest	11.84	-	14.73
Q2	14.74	-	15.68
Q3	15.70	-	16.780
Q4 Slowest	16.781	-	18.75

2-Minute Pushups

Q1 Most	38	-	59.47
Q2	31.1	-	37.82
Q3	25	-	31
Q4 Least	1	-	24.92

TABLE 11. Sites and Types of Injuries Experienced During Basic Training

<u>Injury Site</u>	<u>Frequency</u>
Ankle	33
Calf	26
Foot	33
Hip	1
Knee	31
Lower Back	18
Thigh	5

<u>Injury Type</u>	<u>Frequency</u>
Achilles Tendinitis	3
Ankle Sprain	19
Bursitis	2
Fascitiis	7
Fracture	2
Other Sprain	3
Overuse Knee Injury	18
Pain Not Otherwise Specified	72
Strains	26
Stress Fractures	9
Stress Reactions of Bone	6
Unknown or Not Otherwise Specified	5

TABLE 12. Age, Ethnicity and Education as Risk Factors for Injury

<u>Age Group</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR*</u>	<u>95% CIE (LL, UL) **</u>
17-19	55	110	.333	1.00	-----
20-21	23	38	.377	1.13	(0.77, 1.67)
22-23	8	25	.242	0.73	(0.38, 1.38)
24-25	14	10	.583	1.75	(1.17, 2.61)
26 Plus	12	8	.600	1.80	(1.19, 2.73)
<u>Ethnic Group</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR*</u>	<u>95% CIE (LL, UL)</u>
White NH#	94	147	.390	1.00	-----
Black NH	8	21	.276	0.71	(0.38, 1.30)
Hispanic	4	13	.235	0.60	(0.25, 1.44)
Other	5	10	.333	0.85	(0.41, 1.78)
<u>Educational Level</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Some College	34	54	.386	1.00	-----
High School Graduate	54	110	.329	0.85	(0.61, 1.20)
Less Than HS Graduate	23	27	.460	1.19	(0.80, 1.78)

* Relative Risk

** 95% Confidence interval estimate (lower limit, upper limit)

Non-Hispanic

TABLE 13. Measures of Activity* and Fitness* as Risk Factors for Injury

<u>Job Activity</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR#</u>	<u>95% CIE (LL, UL) ##</u>
Moderate to Heavy	71	140	.336	1.00	-----
Light	23	28	.451	1.34	(0.94, 1.92)
Very Light	12	20	.375	1.11	(0.69, 1.81)
<u>Past Activity</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Active or Very Active	53	130	.289	1.00	-----
Average	45	44	.506	1.75	(1.29, 2.37)
Inactive or Not Very Active	14	16	.467	1.61	(1.03, 2.51)
<u>Physical Fitness</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Above Average or Excellent	37	83	.308	1.00	-----
Average	58	94	.382	1.24	(0.88, 1.73)
Poor or Below Average	17	14	.548	1.78	(1.17, 2.70)
<u>Physical Condition</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Above Average or Excellent	34	79	.327	1.00	-----
Average	64	98	.395	1.31	(0.93, 1.84)
Poor or Below Average	13	14	.482	1.60	(0.99, 2.59)

* * Self-assessed level of physical and fitness.

Relative Risk

95% Confidence interval estimate (lower limit, upper limit)

TABLE 13 (cont)

<u>Frequency of Exercise in Last Month</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Four or More Times/Week	25	60	.294	1.00	-----
One to Three Times/Week	57	93	.380	1.29	(0.88, 1.90)
None to Less Than One Times/Week	30	38	.441	1.50	(0.98, 2.29)
<u>Times Run or Jog per week</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Four or More Times/Week	9	36	.200	1.00	-----
One to Three Times/Week	56	93	.376	1.88	(1.01, 3.49)
None to Less Than One Times/Week	47	61	.435	2.18	(1.17, 4.06)
<u>Categories of Time Spent in Run or Jog per week</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
60 Minutes or More	22	63	.259	1.00	-----
Some Running But Less Than 60 Minutes	55	81	.404	1.56	(1.03, 2.36)
No Running or Jogging	34	45	.430	1.66	(1.07, 2.58)
<u>Sports Participation</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Varsity Letter##	24	49	.329	1.00	-----
2 Years#	58	101	.365	1.11	(0.75, 1.63)
1 Year#	10	25	.286	0.87	(0.47, 1.61)
None	20	26	.435	1.32	(0.83, 2.10)

Any number of years, earning a varsity letter.

Without earning a varsity letter.

TABLE 14. Cigarette Smoking History as Risk Factor for Injury

<u>Smoked in Past Year</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR*</u>	<u>95% CIE (LL, UL) **</u>
No	41	102	.287	1.00	-----
Yes	71	87	.449	1.57	(1.15, 2.14)

<u>No. Cigarettes Smoked/Day@</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
None	11	19	.367	1.00	-----
1-9	10	19	.345	0.94	(0.47, 1.87)
10-19	19	17	.528	1.44	(0.82, 2.53)
20 Plus	30	31	.492	1.34	(0.79, 2.29)

* Relative Risk

** 95% Confidence interval estimate (lower limit, upper limit)

@ Only those smoking one or more cigarettes in the past year

TABLE 15. Previous Injury as Risk Factor for Injury

<u>Previous Injury</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR*</u>	<u>95% CIE (LL, UL) **</u>
No Previous Injury	59	96	.381	1.00	-----
Exercise Injury	25	43	.368	0.97	(0.67, 1.40)
Miss Work Injury	12	30	.286	0.75	(0.45, 1.26)
Both Types	16	22	.421	1.11	(0.72, 1.69)
<u>Site of Previous Injury</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Back NPI@	96	173	.357	1.000	-----
PI@	16	18	.471	1.32	(0.89, 1.95)
Hip NPI	111	188	.371	1.00	-----
PI	1	3	.250	0.67	(0.12, 3.70)
Thigh NPI	111	178	.384	1.00	-----
PI	1	13	.071	0.19	(0.03, 1.24)
Knee NPI	103	161	.390	1.00	-----
PI	9	30	.231	0.59	(0.33, 1.07)
Calf NPI	109	187	.368	1.00	-----
PI	3	4	.429	1.16	(0.49, 2.77)

* Relative Risk

** 95% Confidence interval estimate (lower limit, upper limit)

@ NPI: no previous injury; PI: previous injury

TABLE 15 (cont)

Type of Previous Injury	Injured	Not Injured	Injury Incidence	RR	95% CIE (LL, UL)
Ankle					
NPI	91	155	.370	1.00	-----
PI	21	36	.368	1.00	(0.68, 1.45)
Foot					
NPI	102	176	.367	1.00	-----
PI	10	15	.400	1.09	(0.66, 1.81)
Fracture					
NPI	103	178	.367	1.00	-----
PI	9	13	.409	1.12	(0.66, 1.89)
Stress Fracture					
NPI	110	186	.372	1.00	-----
PI	2	5	.286	0.77	(0.24, 2.50)
Torn Cartilage					
NPI	108	185	.369	1.00	-----
PI	4	6	.400	1.09	(0.50, 2.35)
Torn Ligament					
NPI	106	181	.369	1.00	-----
PI	6	10	.375	1.02	(0.53, 1.95)
Knee Injury					
NPI	96	161	.374	1.00	-----
PI	16	30	.348	0.93	(0.61, 1.43)
Sprained Ankle					
NPI	66	135	.328	1.00	-----
PI	46	56	.451	1.37	(1.03, 1.84)

TABLE 15 (cont)

<u>Type of Previous Injury</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
Other Sprains					
NPI	107	186	.365	1.00	-----
PI	5	5	.500	1.37	(0.72, 2.59)
Tendinitis					
NPI	111	190	.369	1.00	-----
PI	1	1	.500	1.36	(0.34, 5.46)
Ruptured Tendon					
NPI	110	189	.368	1.00	-----
PI	2	2	.500	1.36	(0.50, 3.66)
Pulled Muscle					
NPI	78	141	.356	1.00	-----
PI	34	50	.405	1.14	(0.83, 1.56)

TABLE 16. Current Health Problems as Risk Factors for Injury

<u>Health Problem</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR*</u>	<u>95% CIE (LL, UL) **</u>
Cold or Flu					
No	70	134	.343	1.00	-----
Yes	42	56	.429	1.25	(0.93, 1.68)
Fever					
No	98	175	.359	1.00	-----
Yes	14	15	.483	1.34	(0.89, 2.02)
GI Distress@					
No	96	174	.356	1.00	-----
Yes	15	16	.484	1.36	(0.91, 2.03)
Foot Problems					
No	100	182	.355	1.00	-----
Yes	12	9	.571	1.61	(1.08, 2.41)
Back Pain					
No	96	171	.360	1.00	-----
Yes	16	20	.444	1.24	(0.83, 1.84)
Foot Type					
Flat	12	31	.279	1.00	-----
Normal	97	165	.370	1.33	(0.80, 2.20)
High Arch	10	10	.500	1.79	(0.94, 3.43)
Leg Type					
Bow Leg	10	17	.370	1.00	(0.60, 1.68)
Normal	97	165	.370	1.00	-----
Knock Knee	5	9	.357	0.96	(0.47, 1.98)

* Relative Risk

** 95% Confidence interval estimate (lower limit, upper limit)

@ Nausea, vomiting or diarrhea

TABLE 17. Quintiles* and Ranges of Anthropometric Measures as Risk Factors for Injury

<u>Measure</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR#</u>	<u>95% CIE (LL,UL) ##</u>
Height in cm (min-max)					
Q1 161.8-173.0	18	40	.310	1.00	-----
Q2 173.1-176.8	22	38	.367	1.18	(0.71, 1.96)
Q3 176.9-179.8	25	34	.424	1.37	(0.84, 2.22)
Q4 179.9-183.2	21	37	.362	1.17	(0.70, 1.95)
Q5 183.5-196.3	23	36	.390	1.26	(0.76, 2.07)
Weight in kg (min-max)					
Q1 51.5-66.3	18	42	.305	1.00	-----
Q2 66.4-71.9	30	29	.508	1.67	(1.05, 2.64)
Q3 72.0-76.5	19	40	.322	1.06	(0.62, 1.80)
Q4 76.6-85.1	24	35	.406	1.33	(0.81, 2.18)
Q5 85.2-112.0	19	40	.322	1.06	(0.62, 1.80)
BMI** (min-max)					
Q1 17.82-21.16	20	37	.351	1.00	-----
Q2 21.19-22.51	23	34	.404	1.15	(0.72, 1.85)
Q3 22.52-24.25	23	35	.397	1.13	(0.70, 1.82)
Q4 24.27-26.30	20	37	.351	1.00	(0.61, 1.65)
Q5 26.32-32.47	21	36	.368	1.05	(0.64, 1.71)

* Quintiles Q1-Q5.

Relative Risk

95% Confidence interval estimate (lower limit, upper limit)

** Quetelet Body Mass Index

TABLE 17 (cont)

<u>Measure</u>		<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR</u>	<u>95% CIE (LL, UL)</u>
BFP*						
Q1	7.5-15.4	23	33	.411	1.00	-----
Q2	15.5-17.6	17	40	.298	0.73	(0.47, 1.21)
Q3	17.8-20.5	21	36	.368	0.90	(0.56, 1.42)
Q4	20.6-24.3	24	36	.400	0.97	(0.63, 1.51)
Q5	24.5-33.9	22	33	.400	0.97	(0.62, 1.53)
Pulse** (min-max)						
Q1	14-18	29	49	.372	1.00	-----
Q2	18-21	24	52	.316	0.85	(0.55, 1.32)
Q3	22-23	33	51	.393	1.06	(0.71, 1.56)
Q4	24-29	24	39	.381	1.02	(0.67, 1.57)
Flexibility (min-max)						
Q1	-9.4 - -0.8	30	31	.492	1.00	-----
Q2	-0.7 - 0.6	23	37	.383	0.78	(0.52, 1.17)
Q3	0.6 - 2.9	12	48	.200	0.41	(0.23, 0.72)
Q4	3.0 - 5.4	20	40	.333	0.68	(0.44, 1.05)
Q5	5.5 - 11.2	27	35	.436	0.89	(0.60, 1.30)

* Body Fat Percent.

** Pulse reported in Quartiles.

TABLE 18. Percentiles and Ranges of Fitness Measures as Risk Factors for Injury

<u>Fitness Measures</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>RR*</u>	<u>95% CIE (LL, UL) **</u>
MAXLIFT# (min-max)					
Q1 36.3 - 59	26	39	.400	1.00	-----
Q2 63.5 - 68	33	44	.429	1.07	(0.72, 1.59)
Q3 72.6 - 77.1	21	48	.304	0.76	(0.48, 1.21)
Q4 81.6 - 90.7	31	58	.348	0.87	(0.58, 1.31)
MLWRATIO## (min-max)					
Q1 0.415-0.837	25	35	.417	1.00	-----
Q2 0.839-0.920	23	37	.383	0.92	(0.59, 1.43)
Q3 0.924-0.992	21	39	.350	0.84	(0.53, 1.33)
Q4 0.993-1.071	17	43	.283	0.68	(0.41, 1.12)
Q5 1.074-1.336	25	35	.417	1.00	(0.65, 1.53)
Diagnostic 2-Mile Run/Imputed 2-Mile Run (min-max)					
Fastest 25% 11.84 - 14.73	17	53	.243	1.00	-----
Mid 50% 14.74 - 16.780	54	89	.378	1.55	(0.98, 2.47)
Slowest 25% 16.781 - 18.75	29	42	.409	1.68	(1.02, 2.77)
Diagnostic Pushups/Imputed Pushups (min-max)					
Highest 25% 38 - 59.47	20	51	.282	1.00	-----
Mid 50% 25 - 37.82	48	96	.333	1.18	(0.76, 1.83)
Lowest 25% 1 - 24.92	33	38	.465	1.65	(1.05, 2.58)

* Relative Risk

** 95% Confidence interval estimate (lower limit, upper limit)

Maximum Lift: Maximum amount (kg) lifted overhead.

MLWRATIO: Maximum lift/body weight.

TABLE 19. Quintiles# and Ranges of Total METs Expenditures as Risk Factors for Injury.

<u>Total METs Expended</u>	<u>Injured</u>	<u>Not Injured</u>	<u>Injury Incidence</u>	<u>95% CIE RR* (LL, UL) **</u>
Total Overall METs (min-max)				
Q1 10535 - 66238	23	39	.371	1.00 -----
Q2 6135 - 10212	25	35	.417	1.12 (0.72, 1.75)
Q3 3394 - 6025	22	38	.367	0.99 (0.62, 1.57)
Q4 2046 - 3334	17	44	.288	0.75 (0.45, 1.26)
Q5 0 - 2019	25	35	.412	1.12 (0.72, 1.75)
Total Lower-body METs (min-max)				
Q1 5839 - 25261	21	40	.344	1.00 -----
Q2 3142 - 5754	20	40	.333	0.97 (0.59, 1.59)
Q3 1438 - 3120	22	40	.355	1.03 (0.64, 1.67)
Q4 500 - 1423	21	38	.356	1.03 (0.63, 1.68)
Q5 0 - 493	28	33	.459	1.33 (0.86, 2.07)
Total Upper-body METs (min-max)				
Q1 2218 - 52737	26	37	.413	1.00 -----
Q2 946 - 2186	20	43	.318	0.77 (0.48, 1.23)
Q3 270 - 933	18	44	.290	0.70 (0.43, 1.15)
Q4 16 - 261	29	34	.460	1.12 (0.75, 1.66)
Q5 0 - 13	19	33	.365	0.89 (0.56, 1.41)

Quintiles Q1-Q5.

TABLE 20. Multivariate Models for Risk of Injury.

Variable Level	Full Model* (n=280) AOR@ (LL, UL)@@	Stepwise Model** (n=293) AOR@ (LL, UL)@@
Age		
GE 24	6.85 (2.48, 18.82)	3.74 (1.79, 7.84)
Job Activity		
Light	2.84 (1.25, 6.45)	1.92 (1.05, 3.52)
Physical Activity		
Average or Less	3.30 (1.23, 8.81)	1.76 (0.98, 3.16)
Frequency Running/Jogging		
Less Than 4 Days/Week	4.47 (0.93, 20.53)	2.48 (1.03, 5.97)
Diagnostic/Imputed Pushups		
Mid 50%	0.64 (0.24, 1.69)	0.74 (0.36, 1.52)
Low 25%	2.97 (0.92, 9.43)	2.00 (0.92, 4.34)
Smoking History		
10-19/Day	5.53 (1.48, 20.62)	3.21 (1.35, 7.62)
20+/Day	1.76 (0.68, 4.59)	1.43 (0.72, 2.88)
Flexibility Quintiles		
1	3.56 (1.07, 11.88)	2.88 (1.16, 7.17)
2	2.26 (0.66, 7.67)	1.93 (0.77, 4.87)
3	1.00 -----	
4	1.76 (0.47, 6.63)	1.98 (0.77, 5.08)
5	5.66 (1.59, 20.14)	3.30 (1.33, 8.18)
Previous Injury		
Injured, Not Sprained Ankle	0.60 (0.23, 1.62)	0.54 (0.26, 1.12)
Injured, Sprained Ankle	1.95 (0.77, 4.92)	1.75 (0.94, 3.26)
Unit		
Company 2	1.47 (0.65, 3.31)	1.62 (0.93, 2.82)
Problems With Feet		
Yes	2.02 (0.40, 10.21)	

* All variables forced in. ** Stepwise entry of variables.
 @ Adjusted odds ratio. @@ 95% Confidence interval (lower
 limit, upper limit)

TABLE 20 (cont)

Variable	Full Model (n=280)	Stepwise Model (n=293)
<u>Level</u>	<u>AOR (LL, UL)</u>	<u>AOR (LL, UL)</u>
Self-Assessed Foot Type		
Normal	3.51 (1.11, 11.10)	
High Arches	4.26 (0.78, 23.22)	
Change in Exercise		
None	0.75 (0.28, 1.98)	
Less	0.60 (0.21, 1.71)	
Self-Assessed Physical Condition		
Average or Below	1.19 (0.40, 3.49)	
Diagnostic/Imputed 2-Mile Run		
Mid 50 %	1.78 (0.69, 4.58)	
Slow 25%	2.00 (0.54, 7.44)	
Jog Duration per Week		
Less than 60 Minutes	0.77 (0.25, 2.32)	
None	1.36 (0.36, 5.10)	
Ethnicity		
White	1.63 (0.59, 4.47)	
Self-Assessed Fitness		
Average or Below	0.91 (0.34, 2.44)	
Frequency of Exercise		
Less than 4 days per Week	1.72 (0.67, 4.47)	
Sports Participation		
None	1.27 (0.30, 5.32)	
One Year	1.25 (0.19, 8.18)	
Two Years	0.96 (0.40, 2.30)	
Sick in Previous Two Weeks		
(Cold or Flu, GI distress, or Fever)		
Yes	1.59 (0.73, 3.50)	
Weight Quintiles		
2	1.43 (0.29, 7.03)	
3	0.66 (0.10, 4.54)	
4	0.24 (0.02, 3.02)	
5	0.06 (0.01, 1.95)	

TABLE 20 (cont)

Variable	Full Model (n=280)	Stepwise Model (n=293)
Level	AOR (LL, UL)	AOR (LL, UL)
Height Quintiles		
2	2.84 (0.52, 15.48)	
3	3.83 (0.91, 16.21)	
4	3.39 (0.71, 16.23)	
5	6.34 (0.96, 41.96)	
Body Mass Index Quintiles		
2	1.52 (0.37, 6.30)	
3	3.67 (0.59, 22.67)	
4	2.83 (0.27, 29.47)	
5	4.84 (0.23, 103.24)	
Body Fat Percent Quintiles		
2	0.17 (0.05, 0.57)	
3	0.19 (0.05, 0.70)	
4	0.51 (0.10, 2.53)	
5	1.52 (0.36, 6.30)	
Maximum Lift to Weight Ratio Quintiles		
2	1.46 (0.43, 4.98)	
3	0.75 (0.20, 2.88)	
4	0.55 (0.14, 2.16)	
5	0.81 (0.39, 6.98)	
Total METs Expended		
2	0.68 (0.18, 2.59)	
3	0.21 (0.04, 1.23)	
4	0.13 (0.02, 1.07)	
5	0.09 (0.01, 1.22)	
Total Lower-Body METs Expended		
2	1.12 (0.28, 4.43)	
3	1.28 (0.22, 7.43)	
4	1.15 (0.21, 10.66)	
5	9.43 (1.03, 86.87)	
Total Upper-Body METs		
Quint 2	0.85 (0.24, 3.02)	
Quint 3	0.76 (0.19, 3.05)	
Quint 4	0.85 (0.19, 3.75)	
Quint 5	0.19 (0.03, 1.21)	

APPENDIX A. QUESTIONNAIRE

A-1

PHYSICAL ACTIVITY AND INJURY QUESTIONNAIRE

In this questionnaire you will be asked about yourself and your lifestyle. This will include questions about you, questions about your physical activities during leisure time and at school and work, and questions about your health and injuries you might have had before coming into the Army. You should read instructions carefully and answer all questions as directed. Use the pencil provided to mark your answers on the questionnaire you have been given. Only the first sheet of this questionnaire will have your name and Social Security Number on it. All the other sheets should have your subject number in the upper right corner. Your subject number is in the upper right corner of this page. Check to see that the number in the upper right corner of this first page is the same number that is at the top right corner of all the other pages of this questionnaire. If the number is absent or incorrect notify the monitor. Please print all answers clearly.

I. GENERAL QUESTIONS

NAME _____
Last First MI

SSN _____

DATE OF BIRTH ____/____/____ AGE ____ SEX ____ Male
Mo Day Yr Female

What STATE did you live in before entering the Army? _____
State, Territory or Country

1. EDUCATION: How much education have you had since starting high school? (give number of years of high school and college, technical school, Jr. college or other full time school or training, and years of graduation or last year attended.)

	NUMBER OF YEARS	YEAR OF GRADUATION (OR LAST YEAR)
HIGH SCHOOL	_____	_____
COLLEGE	_____	_____

2. WORK: Have you had a job in the last year? ☐ Yes ☐ No If no wait for the next question.

If yes, give the name of your job or jobs, starting most recent one, and list how many hours per week you work and which months of the year you worked that job.

[illegible]

3. EDUCATION IN LAST YEAR: Were you in school in the last year?

a. ☐ Yes ☐ No If no wait for the next question.

b. If yes, which months were you in school?

Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐Jan ☐

c. In the months you attended school how many days per week did you usually attend classes?

_____ Days per week.

d. About how many hours per day did you attend classes?

_____ Hours per day.

4. NOT IN SCHOOL AND NOT WORK: Were there any months in the last year that you were not in school and also not working at a job?

☐ Yes☐ No If no wait for the next question.

If yes, which months were you both unemployed and not in school?

Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐Jan ☐

II. PHYSICAL ACTIVITIES, SPORTS AND FITNESS

5. PHYSICAL ACTIVITY: In regard to physical activity, how would you describe your life before coming into the Army?

☐ Very active☐ Active☐ Average☐ Not very active☐ Inactive

6. FITNESS ACTIVITY: Have you ever exercised regularly just to keep physically fit in your life? This does not include organized sports. (Regular exercise means exercise 2 or more days per week for 15 minutes or more at least 3 months of the year.)

☐ Yes ☐ No If no wait for the next question.

If yes, what years did you exercise regularly to keep fit?

☐ 86 ☐ 85 ☐ 84 ☐ 83 ☐ 82 ☐ 81 ☐ 80 or earlier

What fitness exercise activities (running, aerobics etc.) did you do most often?

Exercise activities: _____

7. **SPORTS PARTICIPATION:** When you were in high school or college did you participate in any of the following types of sports?

		YEARS PLAYED									
YES	NO	86	85	84	83	82	81	80	79	EARLIER	
<input type="checkbox"/>	<input type="checkbox"/>	Sports with friends, "pick up" games									
<input type="checkbox"/>	<input type="checkbox"/>	Intramural, non-varsity school sports									
<input type="checkbox"/>	<input type="checkbox"/>	Varsity sports in school or college									
<input type="checkbox"/>	<input type="checkbox"/>	Organized non-school team sports, like YMCA or church league basketball, or American legion baseball etc.									

8. **ORGANIZED SPORTS:** What organized sports did you participate in while in high school and/or college? (This includes non-school sports)
List them: _____

9. **VARSITY LETTER:** Did you receive a varsity letter in any high school or college sports?

- ☐ Yes
☐ No If no wate for the next question.

If yes what sports? _____

10. **PHYSICAL FITNESS:** How would you rate your current physical fitness compared to others of your age and sex?

- ☐ Excellent
☐ Above average
☐ Average
☐ Below average
☐ Poor

III. PHYSICAL ACTIVITY IN SCHOOL, AT WORK, AND AT HOME

11. **WALKING:** In the Last Year if you had to go someplace more than a 15 minute walk (3/4 of a mile or 9 blocks) away would you walk there?

- ☐ Always
☐ Less than half the time
☐ More than half the time
☐ Half the time
☐ Never

12. **WEEKLY WALKING:** In the Last Year about how many times per week did you walk more than 15 minutes without stopping? (Don't count walking for exercise or pleasure).

Examples include walking to your school or job, walking at work, etc.

Number times walked per week _____

13. STAIRS: In the Last Year if you had a choice of walking up 3 floors of stairs or taking an elevator, how often would you walk up the stairs?
- ☐ Always ☐ Less than half the time
☐ More than half the time ☐ Never
☐ Half the time
14. FLOORS OF STAIRS: In the average week, over the Last Year about how many floors of stairs did you walk up?
Floors of stairs per week? _____
15. 2 OR MORE FLOORS WALKED UP PER WEEK? In the average week during the Last Year, how often did you walk up 2 or more floors of stairs at one time?
Number of times per week? _____
16. TRANSPORTATION: When you were in high school if you wanted to go someplace more than a 15 minute walk from home how often did you ride in a car?
- ☐ Every time
☐ Most times
☐ Half the time
☐ Few times
☐ Never
17. DAYS PER WEEK CAR USED: When you were in high school about how many days a week did you drive your own car or a family car at least once?
- ☐ Never
☐ 1 or 2 days
☐ 3 or 4 days
☐ 5 or 6 days
☐ 7 days
18. ACCESS TO CAR: In high school did you usually have access to a car, either to drive or ride, when you wanted to go someplace?
- ☐ Yes ☐ No
19. YOUR OCCUPATION LAST YEAR: During the last year, would you describe the amount of physical activity required by your normal occupation (job or school)? Check the one box which best describes your level of activity most of the year.
- ☐ NO PHYSICAL ACTIVITY - unemployed, vacationing etc.
☐ VERY LIGHT PHYSICAL ACTIVITY - student, typist, office worker. Primarily sitting.
☐ LIGHT PHYSICAL ACTIVITY - service person in store or restaurant. Mostly standing or slow walking.
☐ MODERATE PHYSICAL ACTIVITY - construction work, house painter, handyman, mechanic. Work with moderate lifting and carrying.
☐ HEAVY PHYSICAL ACTIVITY - miner, lumber jack, bricklayer, longshoreman, commercial fisherman, etc. Jobs requiring heavy lifting and carrying or using shovels, picks, etc.

IV. PHYSICAL ACTIVITIES IN LAST YEAR

20. In the table below a number of physical activities and sports are listed. Please follow the instructions given and complete each part as directed. Read the list and check "YES" in front of any activities you did in the LAST YEAR. If you did not do an activity check "NO". Next, go back to all activities you checked "YES". Check the months in which you did the activity in the last year; Then give the number of weeks per months you did the activity; the number of days on the average per week you did the activity; and the number of minutes you did the activity on those days. Finally, in the last column rate the level of effort you usually exerted in doing the activity on a scale of 1 to 5 with:

- 1 = VERY EASY - breathing easy, about same as a walk
 2 = EASY - breathing and effort slightly more than a slow walk
 3 = MODERATE - breathing definitely increased, but not uncomfortable
 4 = HARD - breathing hard, have to "push" to keep going, sweating
 5 = VERY HARD - breathing labored, very difficult to keep going, sweating heavily, effort similar to an all out run.

Y E S	N O	ACTIVITY	MONTHS												WKS PER MO	DAYS PER WK	MIN PER DAY	EFFORT LEVEL	
			J	F	M	A	M	J	J	A	S	O	N	D					J
			A	E	A	P	A	U	U	E	C	O	E	A					
			N	B	R	R	Y	N	L	G	P	T	V	C					N
<input type="checkbox"/>	<input type="checkbox"/>	Walking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Hiking/hunting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Stream fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Bicycling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Running/Jogging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Gymnastics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Stretching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Weight lifting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Karate/Judo/ Martial arts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Wrestling/Boxing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Tennis/Squash Racquetball etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Basketball	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Football/Rugby	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Soccer/Field hockey	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Rowing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Canoeing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Down hill skiing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Cross country Skiing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----
<input type="checkbox"/>	<input type="checkbox"/>	Water skiing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----

		J	F	M	A	M	J	J	A	S	O	N	D	J	W/M	SUBJECT NO		
															D/W	M/D	EFFORT	
<input type="checkbox"/>	<input type="checkbox"/> Volleyball	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Gymnastics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Aerobic dance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Ice skating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Roller skating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Social dance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Square dance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Bowling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Golf	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
<input type="checkbox"/>	<input type="checkbox"/> Other, list:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	
	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-----	-----	-----	-----	

V. HEALTH AND PAST INJURIES

21. LOST WORK OR SCHOOL DAYS: Have you ever been suffered an injury or accident that caused you to stay home from school or work for one week or more?

☐ Yes ☐ No If no wait for the next question.

If yes, what was the most recent injury? _____

Also, what year did it occur? _____

22. EXERCISE OR SPORTS INJURES: Have you ever had an exercise or sports related injury that caused you to decrease or quit practicing for 1 week or more?

☐ Yes

☐ No If no wait for the next question.

If yes, what was the most recent injury? _____

Also, what year did it occur? _____

23. SURGERY: Have you ever had an injury or accident that required surgery to repair the damage?

☐ Yes

☐ No If no wait for the next question.

If yes, what was the most recent injury? _____

Also, what year did it occur? _____

24. HOSPITALIZATION: Have you ever had an injury that caused you to be in the hospital over night?

☐ Yes ☐ No If no wait for the next question.

If yes, what was the most recent injury? _____

Also, what year did it occur? _____

SUBJECT NO. _____

25. INJURIES: Have you ever been injured or had an accident to one of the following body parts which caused you to alter your daily activities or to miss school or work for several days? Check yes for those body parts injured this severely. Check no for those not injured this severely. Next, for all those checked yes, give in the spaces provided the name of the injury, the year of the injury, the days it took you to recover fully, and if you got medical help (in an emergency room, a doctor's office, a physical therapist, etc.)

INJURED		BODY PARTS	INJURY NAME	YEAR(S) OF INJURY	DAYS TO RECOVER	MED HELP	
YES	NO					YES	NO
<input type="checkbox"/>	<input type="checkbox"/>	Head	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Neck	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Chest	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Stomach	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Shoulder	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Arm	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Elbow	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Wrist	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Hand	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Back	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Hip	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Thigh	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Knee	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Calf	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Ankle	_____	_____	_____	_____	_____
<input type="checkbox"/>	<input type="checkbox"/>	Foot	_____	_____	_____	_____	_____

26. BACK AND LEG INJURIES: Have you ever had one of the following injuries to your back or legs? Check yes in front of those injuries you have suffered. Check no for those you have not had. For those you have checked yes, for the most recent injury, give the name of the part of the leg injured, side of injury, R = Right, L = Left, B = Both the year of the injury, and the severity of the injury.

1 = Mild injury - mild means the injury did not effect your daily activities

2 = Moderate injury - moderate means the injury affected your daily activities for 1 to 7 days.

3 = Severe injury - severe means it affected your activities for more than 7 days or 1 week.

INJURED		TYPE INJURY	SIDE R, L, B	PART OF LEG	YEAR INJURED	SEVERITY		
YES	NO					1	2	3
<input type="checkbox"/>	<input type="checkbox"/>	Broken bone	_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Stress fracture	_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Torn cartilage	_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Torn ligaments	_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Knee injury	_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Sprained ankle	_____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

INJURED		TYPE INJURY	SIDE R, L, B	PART OF LEG	SUBJECT NO YEAR INJURED	SEVERITY		
YES	NO					1	2	3
<input type="checkbox"/>	<input type="checkbox"/>	Other sprain	----	-----	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Tendonitis	----	-----	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Ruptured tendon	----	-----	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Muscle pull	----	-----	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Other _____	----	-----	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Other _____	----	-----	-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

27. OTHER HEALTH PROBLEMS: Have you ever had a serious illness or health problem other than an injury? Please list all serious illnesses or problems.

☐ Yes

☐ No If no wait for the next question.

If yes, what was the health problem? _____

Also, what year did it occur? _____

28. COLDS OR FLU: Have you had a cold or flu in the last 2 weeks?

☐ Yes ☐ No

29. FEVER: Have you had a fever in the last 2 weeks?

☐ Yes ☐ No

30. NAUSEA AND VOMITING, OR DIARRHEA: Have you had nausea with vomiting, and/or diarrhea in the last two weeks?

☐ Yes ☐ No

VI. EXERCISE AND SPORTS IN THE LAST MONTH

31. EXERCISE IN THE LAST MONTH: Over the last one month, how often did you exercise or play sports for 15 minutes or more?

☐ No exercise or sports in last month

☐ Less than once per week

☐ One time per week

☐ Two or three times per week

☐ Four or more times per week

32. CHANGE IN EXERCISE IN THE LAST MONTH: How did your level of exercise or sports participation in the last month compare to your usual level of the last year?

☐ Did much more exercise in last month

☐ Did more exercise in last month

☐ Did about the same amount of exercise

☐ Did less exercise in last month

☐ Did much less exercise in the last month

33. JOGGING AND RUNNING: In the last month, how many times did you run or jog more than 15 minutes actual running time?
- ☐ None, did not run or jog in last month
- ☐ Less than 1 time per week
- ☐ About 1 time per week
- ☐ 2 to 3 times per week
- ☐ 4 or more times per week
34. DISTANCE OF RUNNING AND JOGGING: In the last month, when you ran or jogged, about how far did you normally go (on an average basis)?
- ☐ Did not run or jog in the last month
- ☐ Less than 1 mile
- ☐ Between 1 and 3 miles
- ☐ 3 to 5 miles
- ☐ More than 5 miles
35. TIME RUNNING OR JOGGING: In the last month, when you ran or jogged, about how many minutes did you usually run (on an average basis)?
- ☐ Did not run or jog
- ☐ Less than 10 minutes
- ☐ Between 10 and 20 minutes
- ☐ 20 to 30 minutes
- ☐ More than 30 minutes
36. OTHER VIGOROUS ACTIVITIES AND SPORTS: In the last month did you do any vigorous exercises or sports other than running that caused you to breath heavily or break into a sweat?
- ☐ Yes
- ☐ No If no wait for the next question.

If yes, what exercises or sports? _____

And, how many times per week? _____

VII. MISCELLANEOUS QUESTIONS

37. BOWED LEGS: Are you more bow legged than most people of your sex?
- ☐ Yes
- ☐ No
38. KNOCK KNEES: Are you more knock kneed than most people of your sex?
- ☐ Yes
- ☐ No

39. FLAT FEET: Do you have flatter feet (lower arches) than most people of your sex?
- ☐ Yes
- ☐ No
40. HIGH ARCHES: Do you have higher arches than most people of your sex?
- ☐ Yes
- ☐ No
41. FOOT PROBLEMS: Do you have problems with your feet that cause you to limit your daily activities some times?
- ☐ Yes
- ☐ No
42. BACK PAIN: Do you have back pain that cause you to limit your daily activities sometimes?
- ☐ Yes
- ☐ No
43. WEIGHT: How much do you weigh? _____ lbs.
44. HEIGHT: What is your height in inches? _____ ins.
45. HANDEDNESS: Are you right or left handed?
- ☐ Right
- ☐ Left
- ☐ Both
46. FOOTEDNESS: Which foot do you prefer to kick a ball with or make a long jump from?
- ☐ Right foot
- ☐ Left foot
- ☐ Both
47. BRAND OF TRAINING SHOES: What brand of training shoes did you buy or bring with you to wear during Army physical training?
- Brand name _____
- Model _____
48. Are your exercise or training shoes made for running?
- ☐ Yes
- ☐ No
- If no, what sport or activity are your training shoes made for?
- Type of shoe: _____
49. COST OF TRAINING SHOES: About how much did your training shoes cost (to the nearest dollar)?
- Cost in dollars _____

50. AGE OF YOUR TRAINING SHOES: About how long ago did you buy your training shoes?

- ☐ Brand new
☐ Less than one week
☐ One week to one month
☐ More than one month but less than six months
☐ Six months to one year
☐ More than one year

51. How well do you think you will fit into the army?

- ☐ Extremely well
☐ Well
☐ Alright
☐ Not too well
☐ Poorly

52. How do you think your physical condition compares to others coming into the Army for the first time?

- ☐ Much better than most
☐ Better than most
☐ About the same
☐ Worse than most
☐ Much worse than most

53. Have you been in the military before?

- ☐ Yes
☐ No

If yes please list the Branch, duration in years of service, and last year served.

SERVICE	DURATION	LAST YEAR
-----	-----	-----
-----	-----	-----
-----	-----	-----

54. Were you in a Fitness Training Unit in the last month?

- ☐ Yes
☐ No

55. Have you smoked one or more cigarettes in the past year?

- ☐ Yes
☐ No If no wait for the next question.

If yes, how many years have you smoked one or more cigarettes? _____

SUBJECT NO. _____

56. If yes, in the one month before coming in the Army, on the average, how many cigarettes did you smoke each day? _____

If yes, how many years have you smoked this many cigarettes each day?

57. During this one month before coming in the Army, what kind of cigarettes did you usually smoke?

☐ Non-Filter ☐ Regular Filters ☐ Low-Tar ☐ Did not smoke any

58. ETHNIC GROUP: What most closely describes your ethnic or racial group?

☐ White, non-hispanic
☐ Black, non-hispanic
☐ Hispanic
☐ American Indian/Eskimo
☐ Oriental/Asian
☐ Other

THANK YOU FOR YOUR VALUABLE TIME AND ASSISTANCE. GOOD LUCK WITH YOUR ARMY CAREER.

APPENDIX B. DAILY TRAINING LOG

A-2

DATE: / /
(DD / MM / YY)

COMPANY: _____ PERSON COMPLETING LOG: _____
(NAME & RANK)

TIME TRAINING

DAY ENDED: _____
(HOUR)

MAJOR TRAINING ACTIVITIES FOR THE DAY: _____

SPECIFIED TRAINING ACTIVITIES
FOR THE FOLLOWING LIST OF ACTIVITIES CHECK "YES" FOR THOSE
PERFORMED AND "NO" FOR THOSE NOT PERFORMED.

YES ==	NO ==	ACTIVITY =====	DURATION =====	DISTANCE =====
()	()	1. RUNNING	_____MIN	_____MILES
()	()	2. ROAD MARCH	_____MIN	_____MILES
()	()	3. BAYONETTE	_____MIN	
()	()	4. PUGIL	_____MIN	
()	()	5. HAND TO HAND	_____MIN	
()	()	6. CONFIDENCE COURSE	_____MIN	
()	()	7. OBSTACLE COURSE	_____MIN	
()	()	8. DRILL & CEREMONY	_____MIN	
()	()	9. STANDING FORMATION	_____MIN	
()	()	10. CALISTHENICS	_____MIN	
()	()	11. STRETCHING	_____MIN	
()	()	12. GAMES (PLEASE LIST)	_____MIN	
		_____	_____MIN	
		_____	_____MIN	
()	()	13. OTHER ACTIVITIES (PLEASE LIST)	_____MIN	
		_____	_____MIN	
		_____	_____MIN	

APPENDIX C. CORRELATION MATRIX OF SELECTED VARIABLES

A-3

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	AGE	TOTMETS	TOTLB
AGE	1.00000	-0.12297	-0.13900
AGE AT LAST BIRTHDAY	0.0000	0.0324	0.0155
	303	303	303
TOTMETS	-0.12297	1.00000	0.85560
TOTAL METS EXPENDED	0.0324	0.0000	0.0001
	303	303	303
TOTLB	-0.13900	0.85560	1.00000
TOTAL LOWER BODY METS EXPENDED	0.0155	0.0001	0.0000
	303	303	303
TOTUB	-0.07592	0.61522	0.33058
TOTAL UPPER BODY METS EXPENDED	0.1875	0.0001	0.0001
	303	303	303
HEIGHT	-0.03354	0.03311	0.07786
	0.5608	0.5659	0.1765
	303	303	303
WEIGHT	0.18714	0.01449	0.00578
	0.0011	0.8016	0.9202
	303	303	303
BODYMASS	0.23500	-0.01656	-0.04801
	0.0001	0.7741	0.4050
	303	303	303
BODYFAT	0.26414	-0.08741	-0.13242
	0.0001	0.1296	0.0213
	302	302	302
MAXLIFT	0.19174	0.17756	0.12051
	0.0008	0.0020	0.0370
	300	300	300
MLWRATIO	0.05731	0.18395	0.13778
	0.3225	0.0014	0.0169
	300	300	300
HEART	-0.00792	-0.12150	-0.12178
	0.8907	0.0345	0.0341
	303	303	303

SPEARMAN CORRELATION COEFFICIENTS
 / PROB > |R| UNDER H₀: RHO=0 / NUMBER OF OBSERVATIONS

	PUSHDX
BODYFAT	-0.21964 0.0002 285
MAXLIFT	0.24460 0.0001 285
MLWRATIO	0.45953 0.0001 285
HEART	-0.01868 0.7531 286
TOETOUCH	0.18046 0.0022 286
DXRUN 2 MILE RUN TIME, DX PT TEST	-0.15091 0.0891 128
DXPU NUMBER OF PUSHUPS, DX PT TEST	1.00000 0.0000 136
DXSU NUMBER OF SITUPS, DX PT TEST	0.36114 0.0001 135
IMPRUN IMPUTED DXRUNSC FROM REGRESSION	-0.40729 0.0001 273
IMPU IMPUTED DXPUSC FROM REGRESSION	0.71311 0.0001 276
RUNDX	-0.28377 0.0001 284

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	IMPRUN	IMPU	RUNDX
IMPRUN	1.00000	-0.52689	0.83234
IMPUTED DXRUNSC FROM REGRESSION	0.0000	0.0001	0.0001
	273	273	273
IMPU	-0.52689	1.00000	-0.47530
IMPUTED DXPUSC FROM REGRESSION	0.0001	0.0000	0.0001
	273	276	274
RUNDX	0.83234	-0.47530	1.00000
	0.0001	0.0001	0.0000
	273	274	284
PUSHDX	-0.40729	0.71311	-0.28377
	0.0001	0.0001	0.0001
	273	276	284
	PUSHDX		
AGE	0.10055		
AGE AT LAST BIRTHDAY	0.0897		
	286		
TOTMETS	0.16463		
TOTAL METS EXPENDED	0.0053		
	286		
TOTLB	0.12007		
TOTAL LOWER BODY METS EXPENDED	0.0425		
	286		
TOTUB	0.25690		
TOTAL UPPER BODY METS EXPENDED	0.0001		
	286		
HEIGHT	-0.22078		
	0.0002		
	286		
WEIGHT	-0.20640		
	0.0004		
	286		
BODYMASS	-0.11805		
	0.0461		
	286		

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	IMPRUN	IMPU	RUNDX
HEIGHT	-0.02894 0.6340 273	-0.26034 0.0001 276	-0.04516 0.4484 284
WEIGHT	0.51537 0.0001 273	-0.27443 0.0001 276	0.45682 0.0001 284
BODYMASS	0.60545 0.0001 273	-0.17510 0.0035 276	0.53074 0.0001 284
BODYFAT	0.63123 0.0001 272	-0.32262 0.0001 275	0.56095 0.0001 283
MAXLIFT	0.03577 0.5562 273	0.40353 0.0001 276	0.01174 0.8442 283
MLWRATIO	-0.44999 0.0001 273	0.71996 0.0001 276	-0.42201 0.0001 283
HEART	0.02227 0.7141 273	-0.01096 0.8561 276	0.02545 0.6694 284
TOETOUCH	-0.07377 0.2244 273	0.18804 0.0017 276	-0.07777 0.1913 284
DXRUN 2 MILE RUN TIME, DX PT TEST	0.66631 0.0001 117	-0.31795 0.0005 118	1.00000 0.0000 128
DXPU NUMBER OF PUSHUPS, DX PT TEST	-0.32837 0.0002 125	0.67181 0.0001 126	-0.20020 0.0194 136
DXSU NUMBER OF SITUPS, DX PT TEST	-0.30709 0.0005 124	0.34567 0.0001 125	-0.27294 0.0014 135

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	DXRUN	DXPU	DXSU
DXRUN	1.00000	-0.14594	-0.21833
2 MILE RUN TIME, DX PT TEST	0.0000	0.1016	0.0141
	128	127	126
DXPU	-0.14594	1.00000	0.37265
NUMBER OF PUSHUPS, DX PT TEST	0.1016	0.0000	0.0001
	127	136	134
DXSU	-0.21833	0.37265	1.00000
NUMBER OF SITUPS, DX PT TEST	0.0141	0.0001	0.0000
	126	134	135
IMPRUN	0.66631	-0.32837	-0.30709
IMPUTED DXRUNSC FROM REGRESSION	0.0001	0.0002	0.0005
	117	125	124
IMPU	-0.31795	0.67181	0.34567
IMPUTED DXPUSC FROM REGRESSION	0.0005	0.0001	0.0001
	118	126	125
RUNDX	1.00000	-0.20020	-0.27294
	0.0000	0.0194	0.0014
	128	136	135
PUSHDX	-0.15091	1.00000	0.36114
	0.0891	0.0000	0.0001
	128	136	135
	IMPRUN	IMPU	RUNDX
AGE	0.09976	0.05828	0.04795
AGE AT LAST BIRTHDAY	0.1000	0.3347	0.4208
	273	276	284
TOTMETS	-0.09542	0.22727	-0.19835
TOTAL METS EXPENDED	0.1157	0.0001	0.0008
	273	276	284
TOTLB	-0.13042	0.15654	-0.17635
TOTAL LOWER BODY METS EXPENDED	0.0312	0.0092	0.0029
	273	276	284
TOTUB	-0.02429	0.31636	-0.09047
TOTAL UPPER BODY METS EXPENDED	0.6894	0.0001	0.1282
	273	276	284

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	DXRUN	DXPU	DXSU
TOTMETS	-0.30582	0.19929	0.07810
TOTAL METS EXPENDED	0.0004	0.0200	0.3679
	128	136	135
TOTLB	-0.20892	0.18078	0.07560
TOTAL LOWER BODY METS EXPENDED	0.0180	0.0352	0.3835
	128	136	135
TOTUB	-0.14213	0.24535	0.17558
TOTAL UPPER BODY METS EXPENDED	0.1095	0.0040	0.0417
	128	136	135
HEIGHT	-0.15065	-0.20896	-0.12994
	0.0896	0.0146	0.1331
	128	136	135
WEIGHT	0.25459	-0.14114	-0.21758
	0.0037	0.1012	0.0112
	128	136	135
BODYMASS	0.36407	-0.04154	-0.21456
	0.0001	0.6311	0.0125
	128	136	135
BODYFAT	0.41764	-0.18395	-0.27372
	0.0001	0.0327	0.0014
	127	135	134
MAXLIFT	-0.02742	0.26692	0.09439
	0.7596	0.0018	0.2780
	127	135	134
MLWRATIO	-0.27756	0.44776	0.30479
	0.0016	0.0001	0.0003
	127	135	134
HEART	0.11073	-0.08168	-0.04726
	0.2134	0.3445	0.5862
	128	136	135
TOETOUCH	-0.05394	0.17965	0.21602
	0.5454	0.0364	0.0119
	128	136	135

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H₀: RHO=0 / NUMBER OF OBSERVATIONS

	MLWRATIO	HEART	TOETOUCH
MLWRATIO	1.00000 0.0000 300	0.00853 0.8830 300	0.12617 0.0289 300
HEART	0.00853 0.8830 300	1.00000 0.0000 303	0.00180 0.9751 303
TOETOUCH	0.12617 0.0289 300	0.00180 0.9751 303	1.00000 0.0000 303
DXRUN 2 MILE RUN TIME, DX PT TEST	-0.27756 0.0016 127	0.11073 0.2134 128	-0.05394 0.5454 128
DXPU NUMBER OF PUSHUPS, DX PT TEST	0.44776 0.0001 135	-0.08168 0.3445 136	0.17965 0.0364 136
DXSU NUMBER OF SITUPS, DX PT TEST	0.30479 0.0003 134	-0.04726 0.5862 135	0.21602 0.0119 135
IMPRUN IMPUTED DXRUNSC FROM REGRESSION	-0.44999 0.0001 273	0.02227 0.7141 273	-0.07377 0.2244 273
IMPU IMPUTED DXPUSC FROM REGRESSION	0.71996 0.0001 276	-0.01096 0.8561 276	0.18804 0.0017 276
RUNDX	-0.42201 0.0001 283	0.02545 0.6694 284	-0.07777 0.1913 284
PUSHDX	0.45953 0.0001 285	-0.01868 0.7531 286	0.18046 0.0022 286
	DXRUN	DXPU	DXSU
AGE AGE AT LAST BIRTHDAY	-0.00110 0.9902 128	0.17942 0.0366 136	-0.03325 0.7019 135

SPEARMAN CORRELATION COEFFICIENTS
 / PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	BODYMASS	BODYFAT	MAXLIFT
RUNDX	0.53074 0.0001 284	0.56095 0.0001 283	0.01174 0.8442 283
PUSHDX	-0.11805 0.0461 286	-0.21964 0.0002 285	0.24460 0.0001 285
	MLWRATIO	HEART	TOETOUCH
AGE	0.05731	-0.00792	0.04904
AGE AT LAST BIRTHDAY	0.3225 300	0.8907 303	0.3950 303
TOTMETS	0.18395	-0.12150	0.06150
TOTAL METS EXPENDED	0.0014 300	0.0345 303	0.2859 303
TOTLB	0.13778	-0.12178	0.03760
TOTAL LOWER BODY METS EXPENDED	0.0169 300	0.0341 303	0.5144 303
TOTUB	0.14599	-0.06588	0.13927
TOTAL UPPER BODY METS EXPENDED	0.0114 300	0.2529 303	0.0153 303
HEIGHT	-0.26123 0.0001 300	-0.04917 0.3938 303	-0.09281 0.1069 303
WEIGHT	-0.33233 0.0001 300	-0.01036 0.8575 303	0.02999 0.6031 303
BODYMASS	-0.22849 0.0001 300	0.00618 0.9146 303	0.08849 0.1243 303
BODYFAT	-0.40235 0.0001 299	0.04456 0.4404 302	-0.04359 0.4504 302
MAXLIFT	0.55479 0.0001 300	0.01053 0.8559 300	0.15066 0.0090 300

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	BODYMASS	BODYFAT	MAXLIFT
BODYMASS	1. 00000 0. 0000 303	0. 83757 0. 0001 302	0. 54323 0. 0001 300
BODYFAT	0. 83757 0. 0001 302	1. 00000 0. 0000 302	0. 28791 0. 0001 299
MAXLIFT	0. 54323 0. 0001 300	0. 28791 0. 0001 299	1. 00000 0. 0000 300
MLWRATIO	-0. 22849 0. 0001 300	-0. 40235 0. 0001 299	0. 55479 0. 0001 300
HEART	0. 00618 0. 9146 303	0. 04456 0. 4404 302	0. 01053 0. 8559 300
TOETOUCH	0. 08849 0. 1243 303	-0. 04359 0. 4504 302	0. 15066 0. 0090 300
DXRUN 2 MILE RUN TIME, DX PT TEST	0. 36407 0. 0001 128	0. 41764 0. 0001 127	-0. 02742 0. 7596 127
DXPU NUMBER OF PUSHUPS, DX PT TEST	-0. 04154 0. 6311 136	-0. 18395 0. 0327 135	0. 26692 0. 0018 135
DXSU NUMBER OF SITUPS, DX PT TEST	-0. 21456 0. 0125 135	-0. 27372 0. 0014 134	0. 09439 0. 2780 134
IMPRUN IMPUTED DXRUNSC FROM REGRESSION	0. 60545 0. 0001 273	0. 63123 0. 0001 272	0. 03577 0. 5562 273
IMPU IMPUTED DXPUSC FROM REGRESSION	-0. 17510 0. 0035 276	-0. 32262 0. 0001 275	0. 40353 0. 0001 276

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	TOTUB	HEIGHT	WEIGHT
DXSU	0.17558	-0.12994	-0.21758
NUMBER OF SITUPS, DX PT TEST	0.0417	0.1331	0.0112
	135	135	135
IMPRUN	-0.02429	-0.02894	0.51537
IMPUTED DXRUNSC FROM REGRESSION	0.6894	0.6340	0.0001
	273	273	273
IMPU	0.31636	-0.26034	-0.27443
IMPUTED DXPUSC FROM REGRESSION	0.0001	0.0001	0.0001
	276	276	276
RUNDX	-0.09047	-0.04516	0.45682
	0.1282	0.4484	0.0001
	284	284	284
PUSHDX	0.25690	-0.22078	-0.20640
	0.0001	0.0002	0.0004
	286	286	286
	BODYMASS	BODYFAT	MAXLIFT
AGE	0.23500	0.26414	0.19174
AGE AT LAST BIRTHDAY	0.0001	0.0001	0.0008
	303	302	300
TOTMETS	-0.01656	-0.08741	0.17756
TOTAL METS EXPENDED	0.7741	0.1296	0.0020
	303	302	300
TOTLB	-0.04801	-0.13242	0.12051
TOTAL LOWER BODY METS EXPENDED	0.4050	0.0213	0.0370
	303	302	300
TOTUB	0.10640	0.02154	0.23638
TOTAL UPPER BODY METS EXPENDED	0.0643	0.7093	0.0001
	303	302	300
HEIGHT	-0.00702	0.00503	0.15223
	0.9031	0.9306	0.0083
	303	302	300
WEIGHT	0.86744	0.73280	0.54449
	0.0001	0.0001	0.0001
	303	302	300

SPEARMAN CORRELATION COEFFICIENTS
 / PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	TOTUB	HEIGHT	WEIGHT
TOTUB	1.00000	0.00859	0.11568
TOTAL UPPER BODY METS EXPENDED	0.0000	0.8816	0.0442
	303	303	303
HEIGHT	0.00859	1.00000	0.44770
	0.8816	0.0000	0.0001
	303	303	303
WEIGHT	0.11568	0.44770	1.00000
	0.0442	0.0001	0.0000
	303	303	303
BODYMASS	0.10640	-0.00702	0.86744
	0.0643	0.9031	0.0001
	303	303	303
BODYFAT	0.02154	0.00503	0.73280
	0.7093	0.9306	0.0001
	302	302	302
MAXLIFT	0.23638	0.15223	0.54449
	0.0001	0.0083	0.0001
	300	300	300
MLWRATIO	0.14599	-0.26123	-0.33233
	0.0114	0.0001	0.0001
	300	300	300
HEART	-0.06588	-0.04917	-0.01036
	0.2529	0.3938	0.8575
	303	303	303
TOETOUCH	0.13927	-0.09281	0.02999
	0.0153	0.1069	0.6031
	303	303	303
DXRUN	-0.14213	-0.15065	0.25459
2 MILE RUN TIME, DX PT TEST	0.1095	0.0896	0.0037
	128	128	128
DXPU	0.24535	-0.20896	-0.14114
NUMBER OF PUSHUPS, DX PT TEST	0.0040	0.0146	0.1012
	136	136	136

SPEARMAN CORRELATION COEFFICIENTS
/ PROB > |R| UNDER H0: RHO=0 / NUMBER OF OBSERVATIONS

	AGE	TOTMETS	TOTLB
TOETOUCH	0.04904 0.3950 303	0.06150 0.2859 303	0.03760 0.5144 303
DXRUN 2 MILE RUN TIME, DX PT TEST	-0.00110 0.9902 128	-0.30582 0.0004 128	-0.20892 0.0180 128
DXPU NUMBER OF PUSHUPS, DX PT TEST	0.17942 0.0366 136	0.19929 0.0200 136	0.18078 0.0352 136
DXSU NUMBER OF SITUPS, DX PT TEST	-0.03325 0.7019 135	0.07810 0.3679 135	0.07560 0.3835 135
IMPRUN IMPUTED DXRUNSC FROM REGRESSION	0.09976 0.1000 273	-0.09542 0.1157 273	-0.13042 0.0312 273
IMPU IMPUTED DXPUSC FROM REGRESSION	0.05828 0.3347 276	0.22727 0.0001 276	0.15654 0.0092 276
RUNDX	0.04795 0.4208 284	-0.19835 0.0008 284	-0.17635 0.0029 284
PUSHDX	0.10055 0.0897 286	0.16463 0.0053 286	0.12007 0.0425 286
	TOTUB	HEIGHT	WEIGHT
AGE AGE AT LAST BIRTHDAY	-0.07592 0.1875 303	-0.03354 0.5608 303	0.18714 0.0011 303
TOTMETS TOTAL METS EXPENDED	0.61522 0.0001 303	0.03311 0.5659 303	0.01449 0.8016 303
TOTLB TOTAL LOWER BODY METS EXPENDED	0.33058 0.0001 303	0.07786 0.1765 303	0.00578 0.9202 303

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